JUDGE SWAIN 08 CV 4851

MAG. FREEMAN

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UNITED STATES DISTRICT COURT
SOUTHERN DISTRICT OF NEW YORK

UNIVERSAL SAFETY RESPONSE, INC., Plaintiff, -against- SECURE USA, INC., and DOES 1 through 10, inclusive, Defendants.	08-Civ-________ ( ) **COMPLAINT** JURY TRIAL DEMANDED

RECEIVED MAY 23 2008 U.S.D.C. S.D. N.Y. CASHIERS

Plaintiff Universal Safety Response, Inc. ("USR"), in its complaint against Defendant SecureUSA, Inc. ("SecureUSA") and Defendant John Does 1 through 10, alleges as follows:

THE PARTIES

1. USR is a corporation organized and existing under the laws of the State of New York. USR is a leading researcher, designer, manufacturer, and provider of vehicle barrier products.

2. Defendant SecureUSA is a corporation organized and existing under the laws of Georgia, having its principal place of business at 4250 Keith Bridge Road, Cumming, Georgia 30041. Upon information and belief, SecureUSA, makes, uses, sells, or offers for sale the vehicle barrier product accused of infringement in this Complaint.

3. USR is unaware of the true name of defendants sued herein as Does 1 through 10, inclusive, and will seek leave to amend this complaint to set forth the true names and capacities

of such fictitiously named defendants when the true names are ascertained. USR is informed and believes, and on that basis alleges, that Does 1 through 10 participated with SecureUSA in the actions alleged below (collectively, SecureUSA and Does 1 through 10 will be referred to herein as "Defendant").

JURISDICTION

4. This is an action for damages and injunctive relief based upon trademark infringement and unfair competition arising under Title 15 of the United States Code, copyright infringement under Title 17 of the United States Code, patent infringement arising under Title 35 of the United States Code and the laws of New York.

5. This Court has subject matter jurisdiction over this action under 28 U.S.C. § 1338, which confers jurisdiction over cases of trademark infringement, unfair competition, copyright infringement and patent infringement, and 28 U.S.C. § 1331, which confers federal question jurisdiction. The Court has supplemental jurisdiction over the New York state law claims under 28 U.S.C. § 1367.

6. This Court has general personal jurisdiction over SecureUSA because SecureUSA is actively registered with the New York State Department of State. (A copy of SecureUSA's registration is attached as Exhibit 1 hereto).

7. This Court has personal jurisdiction over SecureUSA because, upon information and belief, SecureUSA has sold or offered for sale infringing vehicle barriers in this District and elsewhere in the United States.

VENUE

8. Venue is proper in this judicial district under 28 U.S.C. §§ 1391(c) and 1400(b).

USR'S TRADEMARKS AND GOODWILL

9. USR is a leading designer, manufacturer and marketer of vehicle barrier systems, perimeter security solutions and provider of related services. USR's product offerings include a highly innovative and successful line of vehicle barrier system known as the Ground Retractable Automobile Barrier system, which is marketed and sold by USR under the trademark GRAB (the "GRAB Mark"). USR has used the GRAB Mark in connection with its vehicle barrier systems since at least 2002. In addition to its long and extensive use of the GRAB Mark, USR has extensively advertised and promoted its GRAB Mark.

10. USR is the owner of U.S. Trademark No. 2,767,400 for the word GRAB in respect of a "vehicle arresting system, namely an automatically deployed restraining barrier primarily composed of steel, and also composed of concrete and netting" which was issued on September 23, 2003 (the "GRAB Registration"). (A copy of the Certificate for the GRAB Registration is attached at Exhibit 2 hereto).

11. By virtue of USR's extensive use, advertising and promotion efforts, the GRAB Mark has achieved strong consumer recognition and represents valuable goodwill of USR. USR's innovative vehicle barrier systems and the goodwill associated with its GRAB Mark are invaluable to USR's continued success.

USR'S COPYRIGHT

12. USR is, and at all relevant times has been, the copyright owner under U.S. Copyright Law with respect to the literary and photographic works contained in a promotional brochure entitled "The fastest growing BARRIER TECHNOLOGY in the world" (the "GRAB Brochure").

13. The GRAB Brochure is the subject of a valid Copyright Registration No. TX6-840-385 ("USR Copyright Registration"). The date of the USR Copyright Registration is May 13, 2008. (A copy of the record for the USR Copyright Registration is attached Exhibit 3 hereto).

USR'S PATENTS

14. USR is the assignee and owner of the following United States patents ("USR's Patents"):

a) U.S. Patent No. 7,195,419 ("the '419 patent", a copy of which is attached at Exhibit 4 hereto), entitled "Net And Mat"", which was duly and legally issued on March 27, 2007 to Matthew A. Gelfand; and

b) U.S. Patent No. 7,210,873 ("the '873 patent", a copy of which is attached at Exhibit 5 hereto), entitled "Energy Absorbing System With Support", which was duly and legally issued on May 1, 2007 to Matthew A. Gelfand.

FIRST CLAIM FOR RELIEF
(Federal Trademark Infringement Under 15 U.S.C. §1114)

15. USR realleges and incorporates by reference herein the allegations contained above.

16. USR is the owner of the GRAB Mark as used to identify and promote its vehicle barrier systems.

17. On information and belief, Defendant has used and is using USR's GRAB Mark to identify and promote its vehicle barrier systems without USR's consent.

18. Defendant's unauthorized use of the GRAB Mark is causing and will continue to cause public confusion as the source of Defendant's products, and sponsorship and/or affiliation of Defendant with USR.

19. Defendant's unauthorized use of the GRAB Mark constitutes infringement of USR's federally registered GRAB trademark in violation of Section 32 of the United States Trademark Act of 1946, as amended, 15 U.S.C. § 1114.

20. Upon information and belief, Defendant's conduct has been willful and in conscious disregard of USR's trademark rights.

21. Defendant's wrongful acts have caused, and unless enjoined will continue to cause, monetary damage and irreparable injury to USR and the GRAB Mark for which there is no adequate remedy at law.

SECOND CLAIM FOR RELIEF
(Federal Unfair Competition Under 15 U.S.C. §1125(a))

22. USR realleges and incorporates by reference herein the allegations contained above.

23. Defendant's use of the GRAB Mark is likely to cause confusion and mistake and to deceive customers as to the affiliation, connection or association of Defendant with USR, and to falsely designate or represent the origin of its products.

24. Such use constitutes unfair competition under section 43(a) of the United States Trademark Act of 1946, 15 U.S.C. §1125(a).

25. Upon information and belief, Defendant's conduct has been willful and in conscious disregard of USR's trademark rights.

26. Defendant's wrongful acts have caused, and, unless enjoined will continue to cause monetary damage and irreparable injury to USR and the GRAB Mark for which there is no adequate remedy at law.

THIRD CLAIM FOR RELIEF
(Trademark Infringement and Unfair Competition Under New York Law)

27. USR realleges and incorporates by reference herein the allegations contained above.

28. The aforesaid acts of Defendant constitute trademark infringement and unfair competition in violation of the common law of the State of New York.

29. The aforesaid actions of Defendant have caused, and unless enjoined will continue to cause, monetary damage and irreparable injury to USR and the GRAB Mark for which there is no adequate remedy at law.

FOURTH CLAIM FOR RELIEF
(Federal Copyright Infringement Under 17 U.S.C. §501)

30. USR realleges and incorporates by reference herein the allegations contained above.

31. USR is, and at all relevant times has been, the copyright owner under U.S. Copyright Law with respect to the GRAB Brochure. The GRAB Brochure is the subject of a valid Copyright Registration issued by the Register of Copyrights to USR as specified on Exhibit 3.

32. Upon information and belief, Defendant copied without USR's permission text and photographs on a promotional flyer entitled "GRAB System" (the "Defendant's Infringing Flyer"), which is being distributed to the public by Defendant, and made available to the public on the website located at www.secureaus.com.au/product%20pdf/GRAB%20System%20(SU-GRAB).pdf. (A copy of the Defendant's Infringing Flyer is attached at Exhibit 6 hereto). The

reproduced text works and photographs are copied from the GRAB Brochure registered for copyright protection under registration No. TX6-840-385.

33. Defendant's reproduction of USR's copyrighted text and photographic works in Defendant's Infringing Flyer constitutes copyright infringement under 17 U.S.C. §501.

34. Upon information and belief, Defendant reproduced without USR's permission text and photographs on the webpage located at www.secureaus.com.au/Products_VehicleBarriers_NonLethal.asp (the "Defendant's Infringing Webpage") which is available to U.S. consumers. (A copy of the Defendant's Infringing Webpage is attached at Exhibit 7 hereto). The copied text and photographs are taken from the GRAB Brochure registered for copyright protection under registration No. TX6-840-385.

35. Defendant's reproduction of USR's text and photographic works in the Defendant's Infringing Webpage constitutes copyright infringement under 17 U.S.C. §501.

36. Upon information and belief, Defendant's copyright infringements of USR's GRAB Brochure have been willful and in conscious disregard of USR's rights.

37. Defendant's infringements of the copyrights in and to the GRAB Brochure has caused both irreparable and monetary damage to USR, including injury to its business reputation as well as loss of past and prospective income. USR is entitled to recover from Defendant the damages it has sustained and will sustain, and any gains, profits and advantages obtained by Defendant as a result of the infringing acts identified above.

FIFTH CLAIM FOR RELIEF
(Infringement of the '419 Patent Under 35 U.S.C. § 271)

38. USR realleges and incorporates by reference herein the allegations contained above.

39. Defendant has been and still is infringing one or more claims of the '419 patent by making, using, offering for sale, selling, and/or importing into the United States vehicle barriers. Infringing vehicle barriers made, used, sold, offered for sale or imported by Defendant include at least Defendant's GRAB SYSTEM K-12 barrier.

40. Defendant's actions constitute infringement, active inducement of infringement, and/or contributory infringement of the '419 patent in violation of 35 U.S.C. § 271.

41. USR has sustained damages and will continue to sustain damages as a result of the aforesaid acts of infringement.

42. Defendant's continued infringement of the '419 patent has caused and will continue to cause USR irreparable harm unless enjoined by the Court.

43. On information and belief, Defendant's infringement of the '419 patent have been willful.

SIXTH CLAIM FOR RELIEF
(Infringement of the '873 Patent Under 35 U.S.C. § 271)

44. USR realleges and incorporates by reference herein the allegations contained above.

45. Defendant has been and still is infringing one or more claims of the '873 patent by making, using, offering for sale, selling, and/or importing into the United States vehicle barriers. Infringing vehicle barriers made, used, sold, offered for sale or imported by Defendant include at least Defendant's GRAB SYSTEM K-12 barrier.

46. Defendant's actions constitute infringement, active inducement of infringement, and/or contributory infringement of the '873 patent in violation of 35 U.S.C. § 271.

47. USR has sustained damages and will continue to sustain damages as a result of the aforesaid acts of infringement.

48. Defendant's continued infringement of the '873 patent has caused and will continue to cause USR irreparable harm unless enjoined by the Court.

49. On information and belief, Defendant's infringement of the '873 patent have been willful.

PRAYER FOR RELIEF

WHEREFORE, USR prays that this Court enter judgment in its favor and against Defendant and grant the following relief:

A. A temporary, preliminary and permanent injunction directing and restraining Defendant, its officers, agents, servants, employees, attorneys, parents, subsidiaries, and other persons in active concert or participation with Defendant, from:

a) using in any manner the GRAB Mark, or any term confusingly similar thereto;

b) committing any acts calculated to cause consumers to believe that any products or services sold, licensed or offered by Defendant are sponsored by, approved by, connected with, supported by, guaranteed by, sold by, or offered by USR or are under the control or supervision of USR;

c) unfairly competing with USR in any manner; and

d) infringing the copyright in USR's registered GRAB Brochure (the subject of Federal Copyright Registration No. TX6-840-385) by reproducing text and photographs from the GRAB Brochure in any manner, including on SecureUSA's websites and promotional material.

B. An order requiring Defendant to:

a) delete all references to the GRAB Mark as well as any other confusingly similar variations thereof from any electronic materials in its possession, custody or control, from any advertising materials or marketing presentations, and from the Internet website at www.secureaus.com.au;

b) deliver to USR for destruction all goods and materials that Defendant has in its possession that bear the GRAB Mark;

C. An order impounding all infringing reproductions of USR's copyrighted works and as part of final judgment, the destruction of same, pursuant to 17 U.S.C. §503;

D. A preliminary and permanent injunction preventing further infringement, contributory infringement and inducement of infringement of USR's Patents;

E. An order requiring Defendant, within thirty (30) days after entry of judgment, to file with this Court and serve upon USR an affidavit setting forth in detail the manner in which Defendant has complied with the preceding paragraphs;

F. Damages in an amount to be determined at trial;

G. An order that Defendant's patent infringement, trademark infringement, unfair competition and copyright infringement was willful;

H. An award of punitive damages;

I. Damages in an amount no less than $150,000 for each count of copyright infringement alleged herein pursuant to 17 U.S.C. §504(c)(2);

J. A trebling of damages pursuant to 35 U.S.C. § 284 and 15 U.S.C. § 1117;

K. An assessment and award of interest, including pre-judgment interest, on the damages determined;

L. An award of Plaintiffs' costs and attorney fees in this action pursuant to 15 U.S.C. § 1117 and 17 U.S.C. § 505; and

M. Such other and further relief as this Court deems just and proper.

DEMAND FOR JURY TRIAL

Plaintiff hereby demands a trial by jury as to all claims and all issues properly triable thereby.

Respectfully submitted,

Dated: May 23, 2008

By: Frank A. Bruno for

Milbank, Tweed, Hadley & McCloy LLP
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New York, NY 10005
Telephone: (212) 530-5000
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Attorneys for Plaintiff
Universal Safety Response, Inc.

Exhibit 1

NYS Department of State

Division of Corporations

Entity Information

Selected Entity Name: SECURE USA, INC.

Selected Entity Status Information

Current Entity Name: SECURE USA, INC.
Initial DOS Filing Date: MAY 09, 2002
County: NEW YORK
Jurisdiction: GEORGIA
Entity Type: FOREIGN BUSINESS CORPORATION
Current Entity Status: ACTIVE

Selected Entity Address Information

DOS Process (Address to which DOS will mail process if accepted on behalf of the entity)

SECURE USA, INC.
233 BROADWAY 22ND FLOOR
NEW YORK, NEW YORK, 10279

Registered Agent

DARRY BEAM
233 BROADWAY 22ND FLOOR
NEW YORK, NEW YORK, 10279

NOTE: New York State does not issue organizational identification numbers.

Search Results New Search

Division of Corporations, State Records and UCC Home Page NYS Department of State Home Page

Exhibit 2

Int. Cls.: 6 and 19

Prior U.S. Cls.: 1, 2, 12, 13, 14, 23, 25, 33, and 50

United States Patent and Trademark Office

Reg. No. 2,767,400

Registered Sep. 23, 2003

TRADEMARK
PRINCIPAL REGISTER

GRAB

UNIVERSAL SAFETY RESPONSE, INC. (NEW YORK CORPORATION)
48 ARRANDALE ROAD
ROCKVILLE CENTRE, NY 11570

FOR: VEHICLE ARRESTING SYSTEM, NAMELY AN AUTOMATICALLY DEPLOYED RESTRAINING BARRIER PRIMARILY COMPOSED OF STEEL, AND ALSO COMPOSED OF CONCRETE AND NETTING, IN CLASS 6 (U.S. CLS. 2, 12, 13, 14, 23, 25 AND 50).

FIRST USE 2-12-2003; IN COMMERCE 2-12-2003.

FOR: VEHICLE ARRESTING SYSTEM, NAMELY AN AUTOMATICALLY DEPLOYED RESTRAINING BARRIER PRIMARILY COMPOSED OF CONCRETE AND NETTING AND ALSO COMPOSED OF STEEL, IN CLASS 19 (U.S. CLS. 1, 12, 33 AND 50).

FIRST USE 2-12-2003; IN COMMERCE 2-12-2003.

SN 76-208,416, FILED 2-12-2001.

HELLEN BRYAN-JOHNSON, EXAMINING ATTORNEY

Exhibit 3

Type of Work: Text

Registration Number / Date:
TX0006840385 / 2008-05-13

Application Title: The Fastest Growing BARRIER TECHNOLOGY in the World.

Title: The Fastest Growing BARRIER TECHNOLOGY in the World.

Description: Print material.

Copyright Claimant:
Universal Safety Response, Inc.

Date of Creation: 2005

Date of Publication:
2005-08-15

Nation of First Publication:
United States

Authorship on Application:
Universal Safety Response, Inc, employer for hire;
Citizenship: United States. Authorship: entire text with inserts, photographs and illustrations.

Names: Universal Safety Response, Inc

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Exhibit 4

US007210873B2

(12) **United States Patent**
Gelfand

(10) **Patent No.: US 7,210,873 B2**
(45) **Date of Patent: May 1, 2007**

(54) **ENERGY ABSORBING SYSTEM WITH SUPPORT**

(75) Inventor: **Matthew Gelfand**, Rockville Centre, NY (US)

(73) Assignee: **Universal Safety Response, Inc.**, Franklin, TN (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **10/726,839**

(22) Filed: **Dec. 2, 2003**

(65) **Prior Publication Data**

US 2005/0117967 A1 Jun. 2, 2005

(51) **Int. Cl.**
E01F 15/00 (2006.01)

(52) **U.S. Cl.** **404/6**

(58) **Field of Classification Search** ..... 404/6, 404/9, 10; 244/110 C, 110 F, 110 R; 49/34, 49/49
See application file for complete search history.

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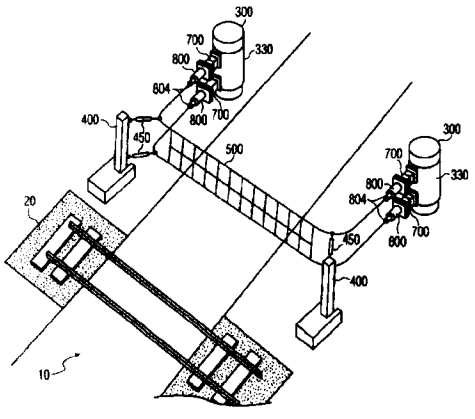
(Continued)

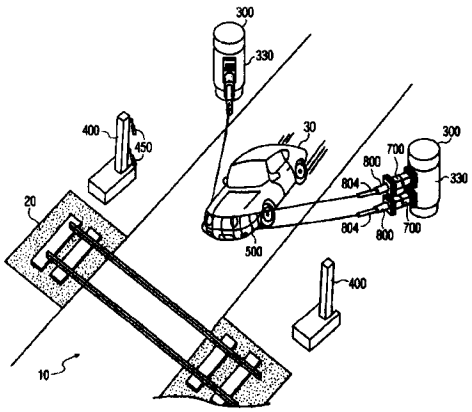
Primary Examiner—Gary S. Hartmann
(74) *Attorney, Agent, or Firm* Milbank Tweed Hadley & McCloy LLP

(57) **ABSTRACT**

An energy absorbing system. The system includes an anchor, a net mechanically coupled to the anchor, and a support mechanically coupled to the net via a frangible connector, wherein the frangible connector uncouples the support from the net upon application of at least a threshold force to the frangible connector. In another aspect, the system further includes an energy absorber mechanically coupling the net and the anchor. In another aspect, the system further includes a joint mechanically coupling the energy absorber and the anchor, wherein the joint pivots on a horizontal axis.

10 Claims, 13 Drawing Sheets





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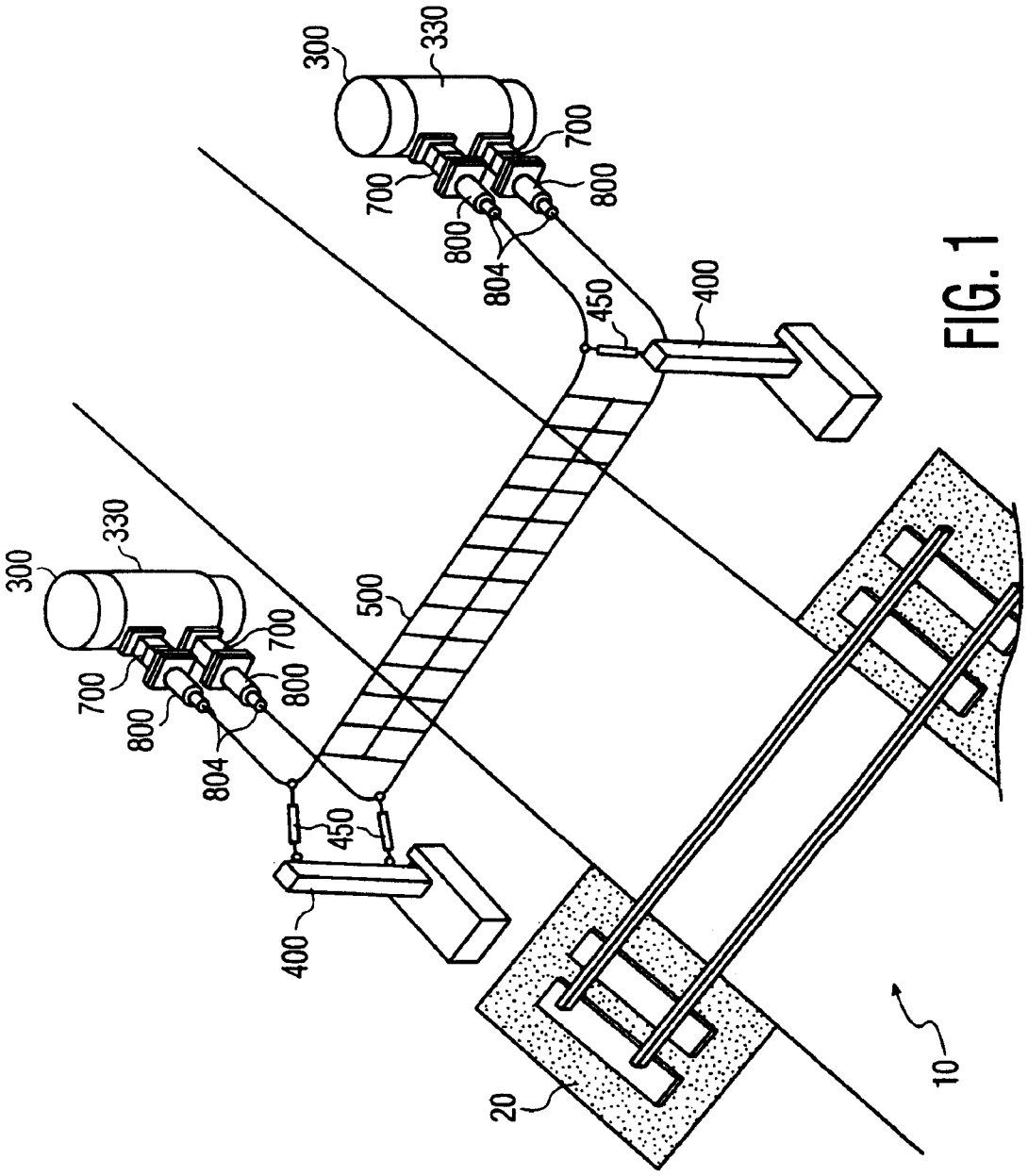

FIG. 1

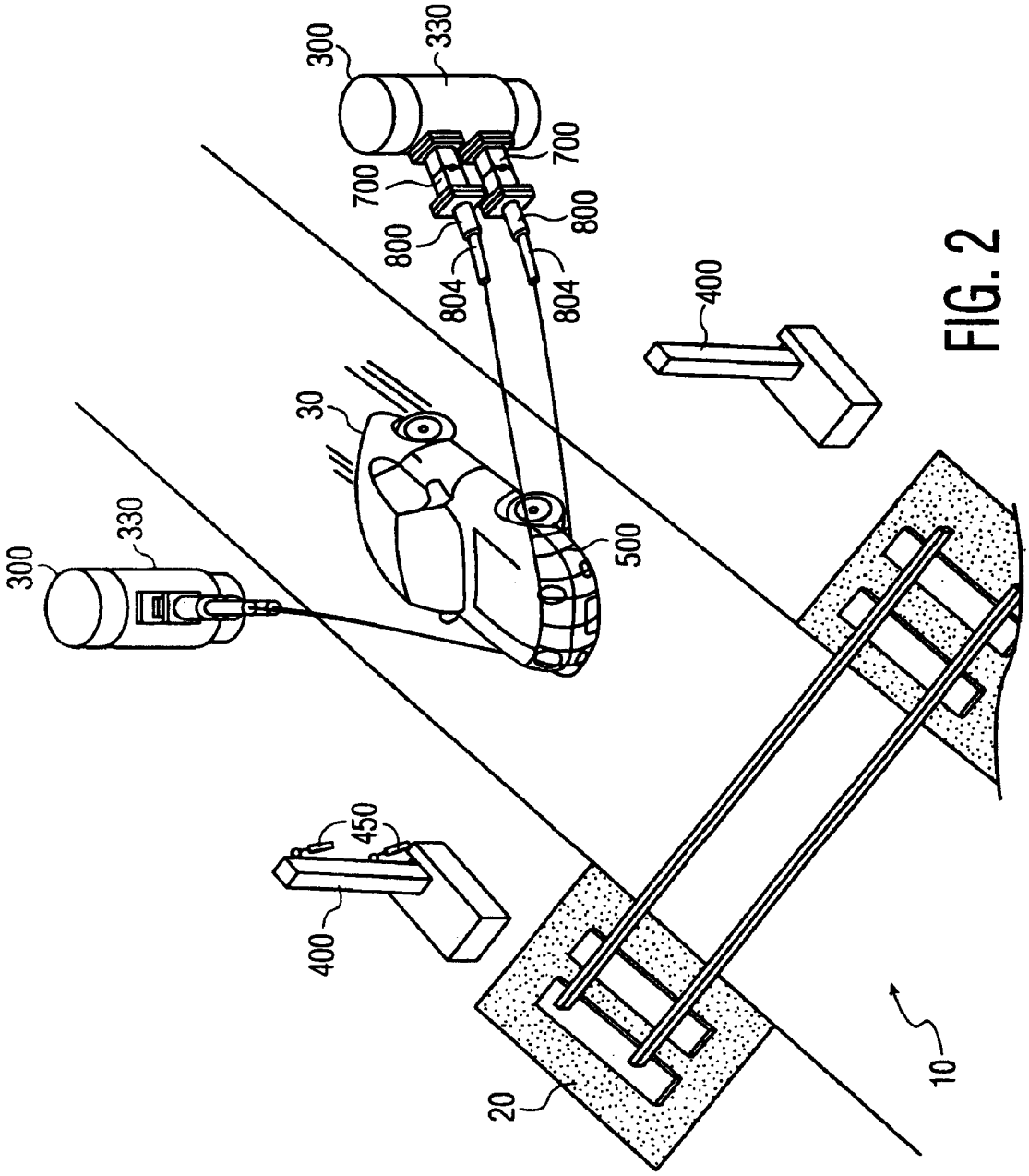

FIG. 2

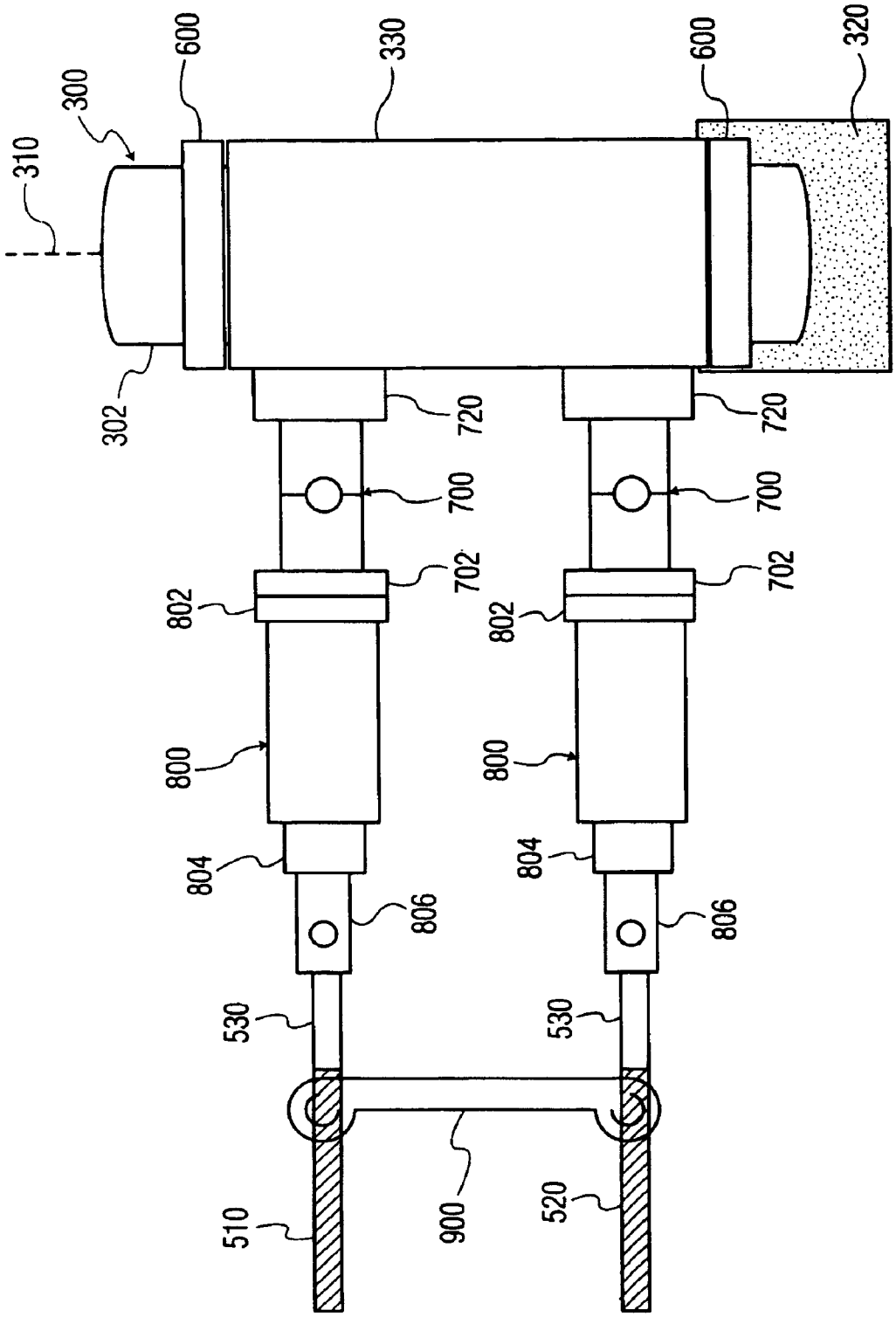
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FIG. 3A

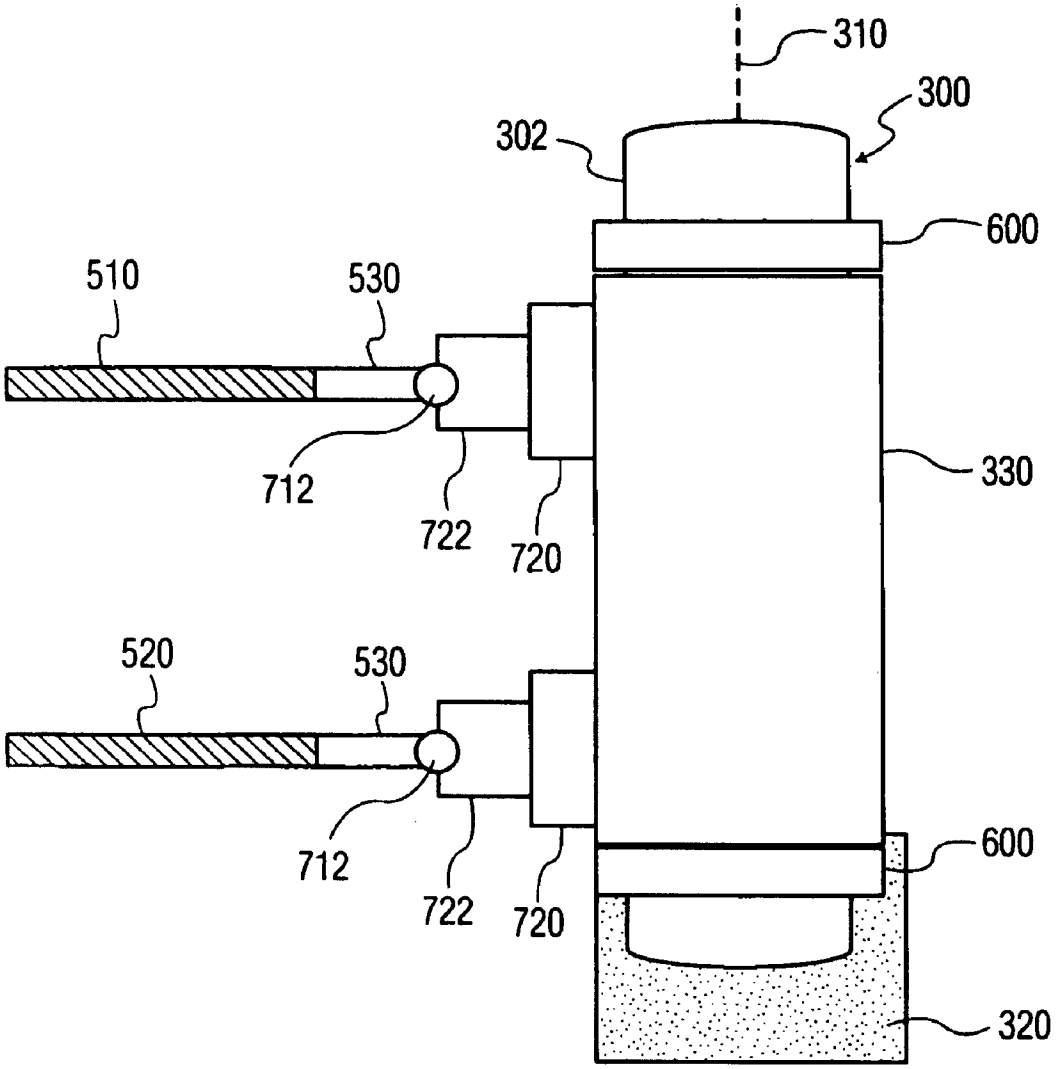
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FIG. 3B

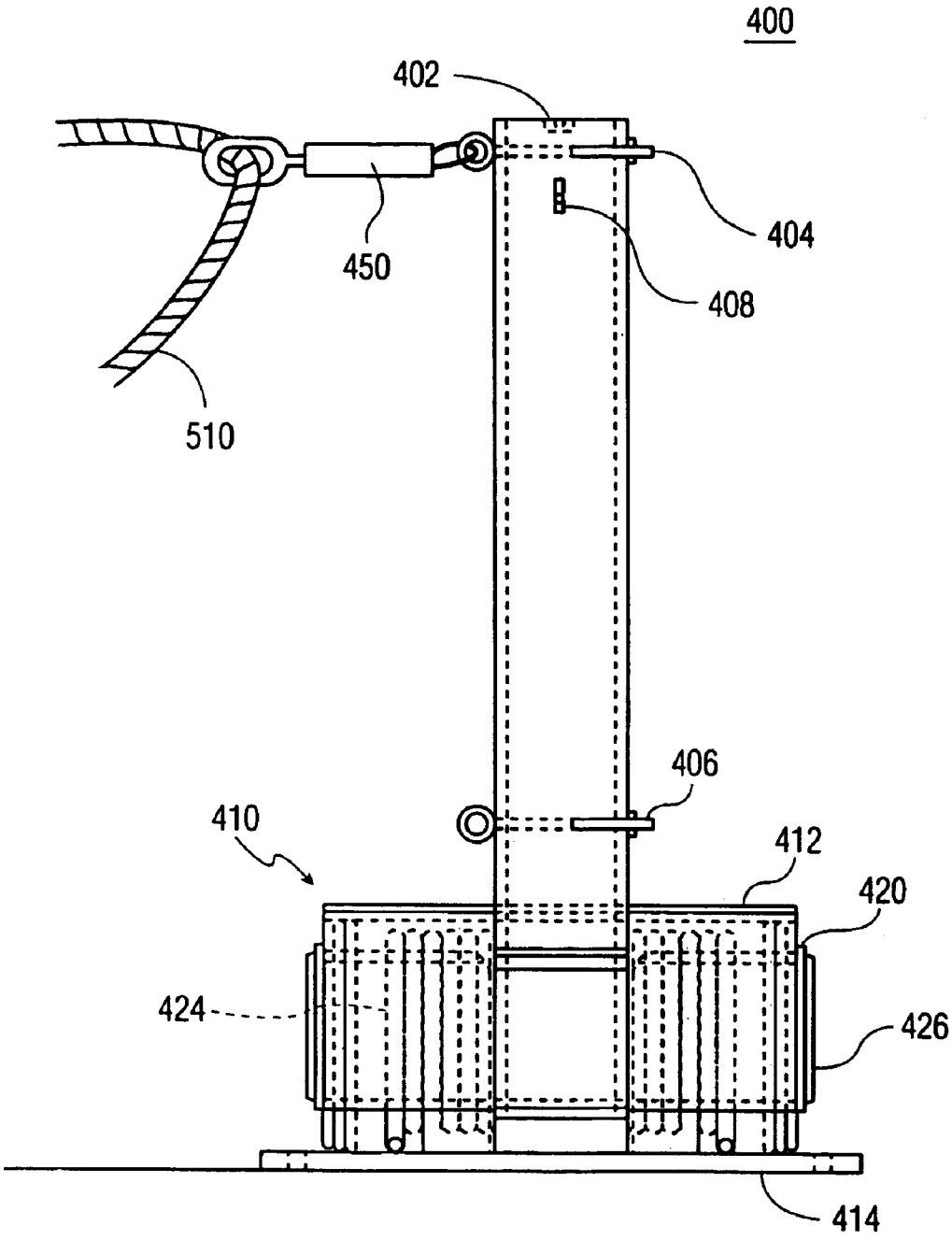

FIG. 4A

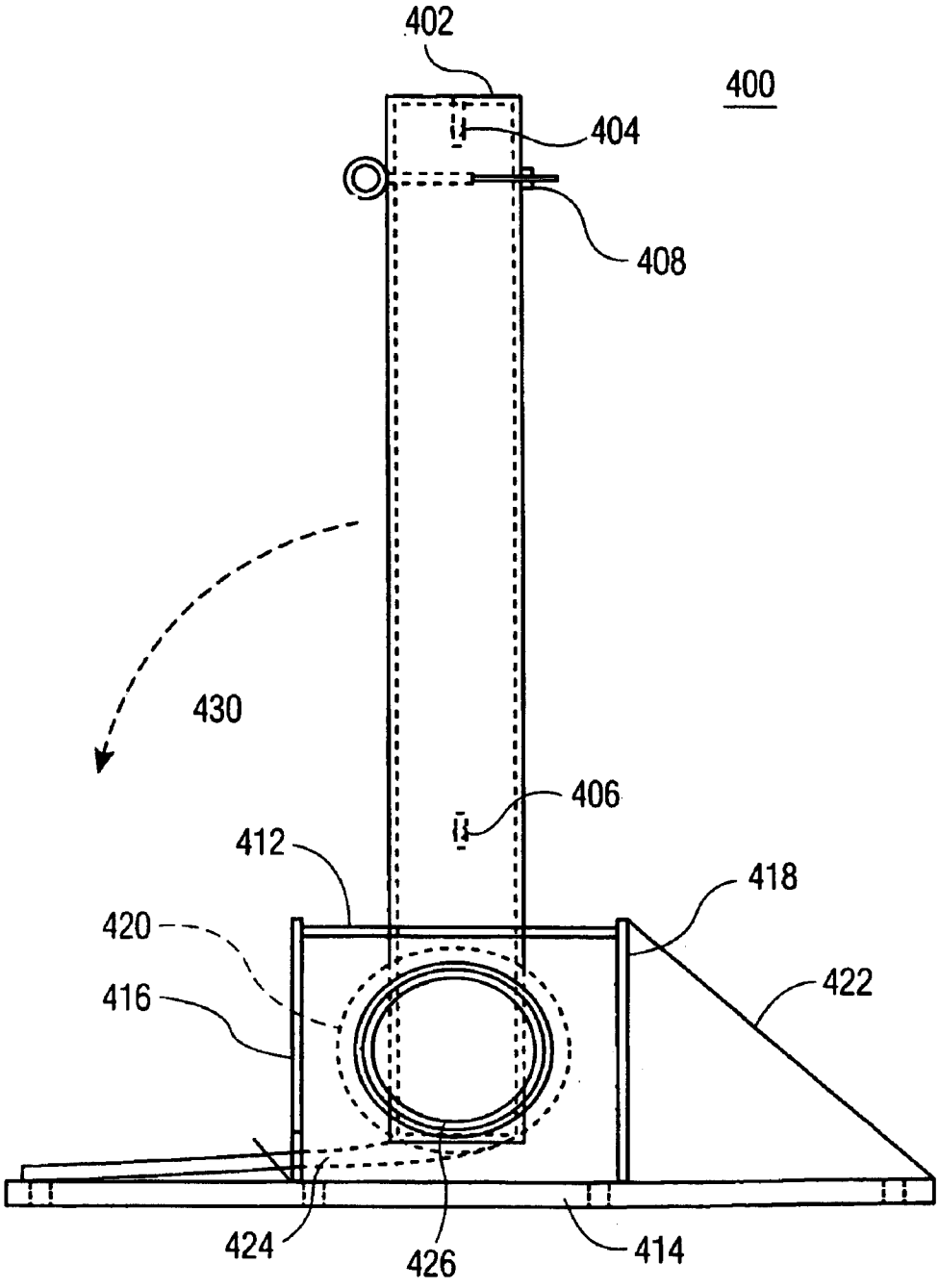

FIG. 4B

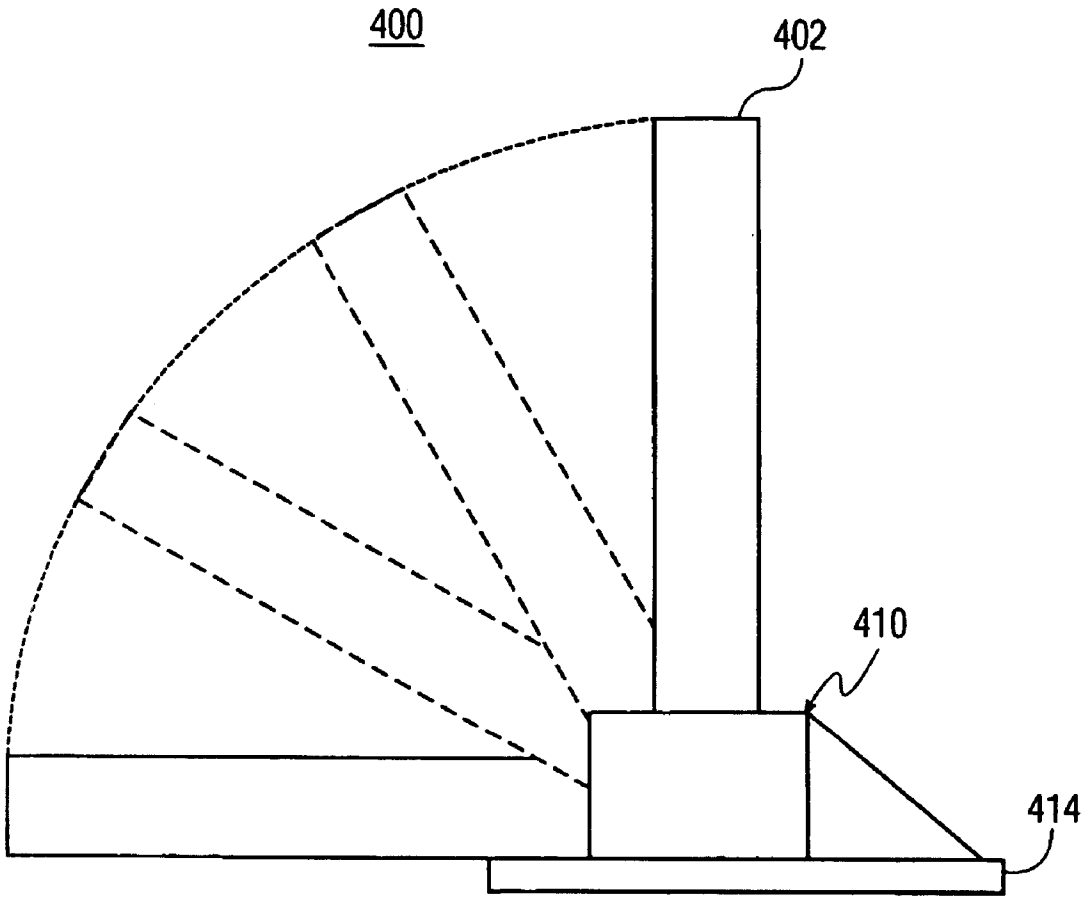

FIG. 4C

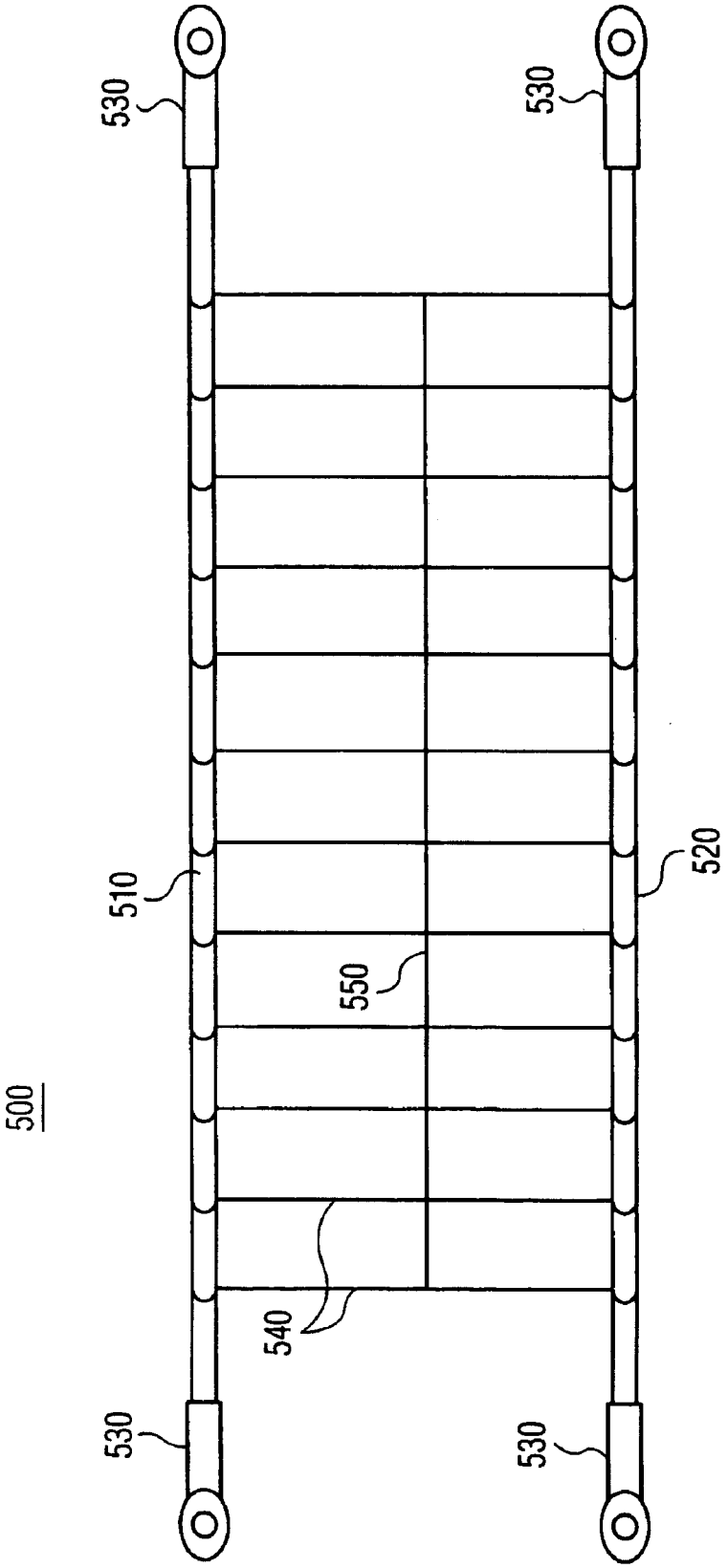

FIG. 5

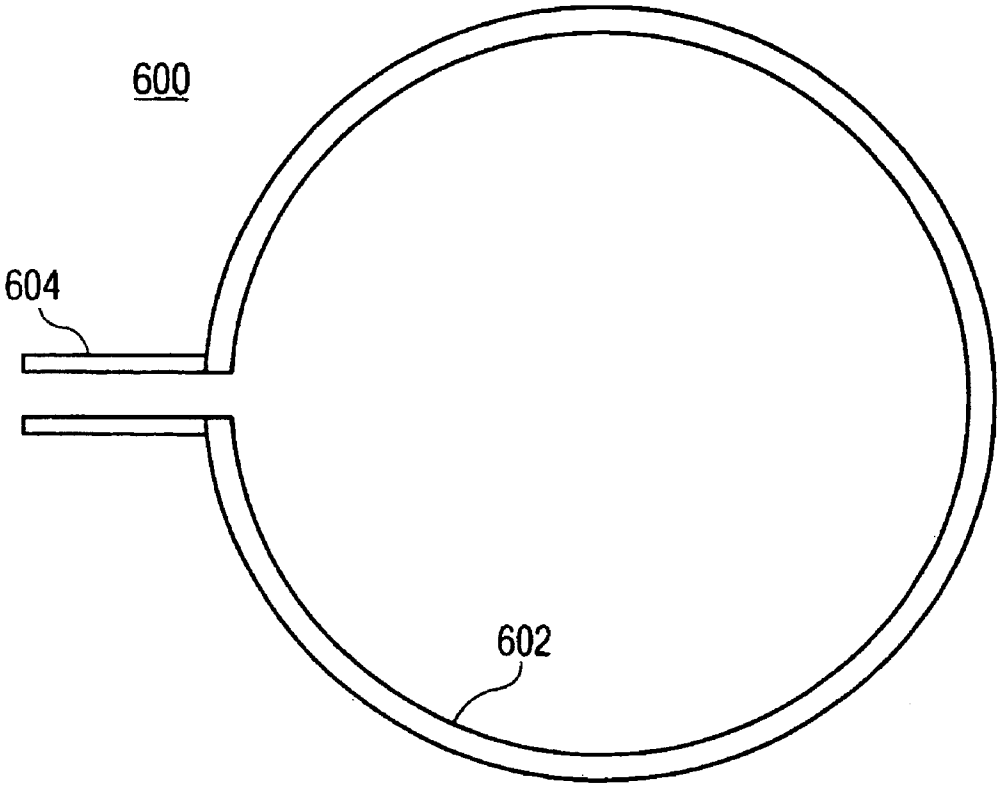

FIG. 6A

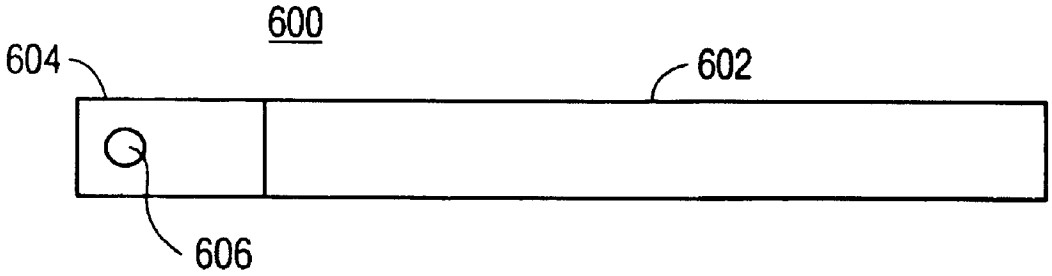

FIG. 6B

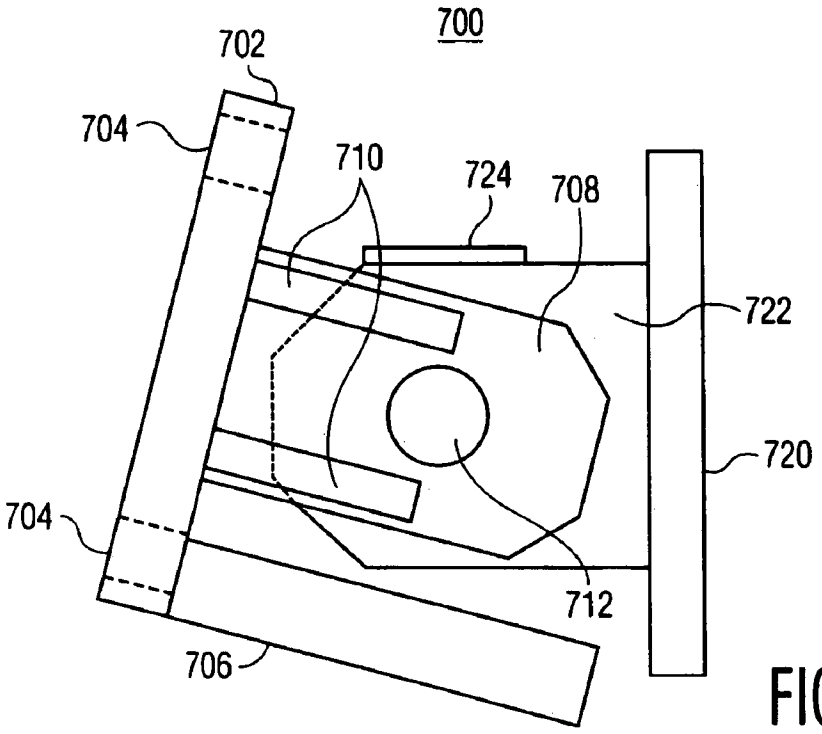
700
702
704
710
724
708
722
720
704
712
706

FIG. 7A

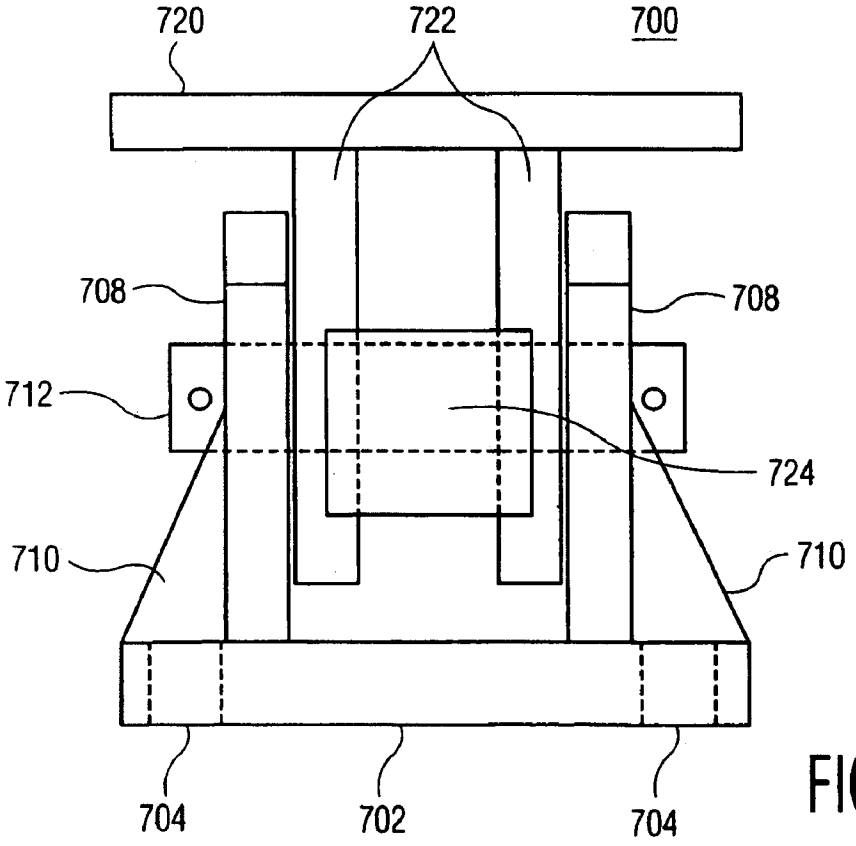
720
722
700
708
708
712
724
710
710
704
702
704

FIG. 7B

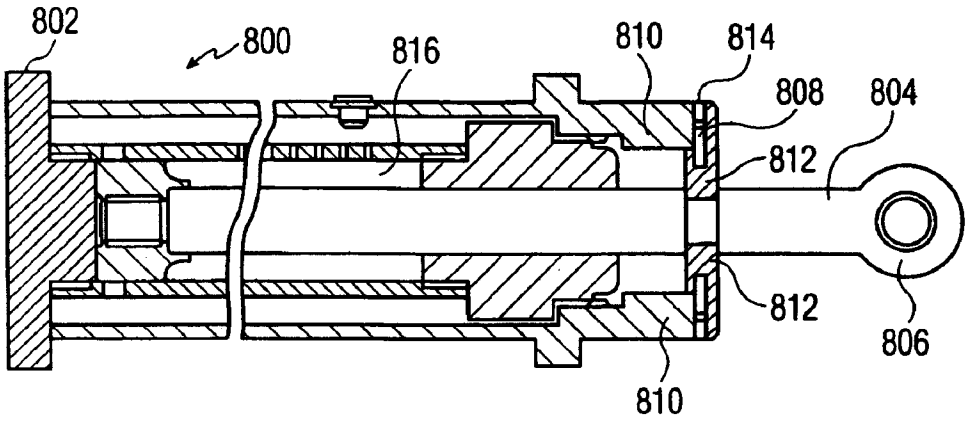
802
800
816
810
814
808
804
812
812
806
810

FIG. 8A

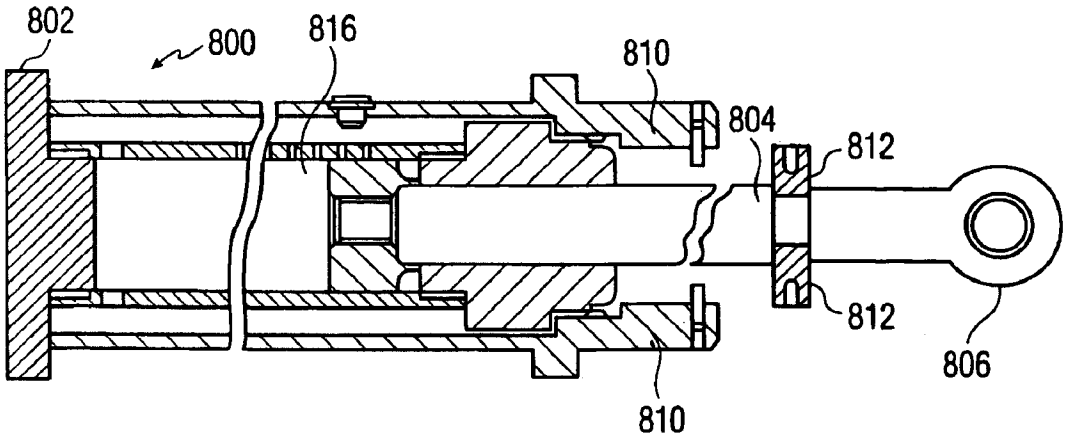
802
800
816
810
804
812
812
806
810

FIG. 8B

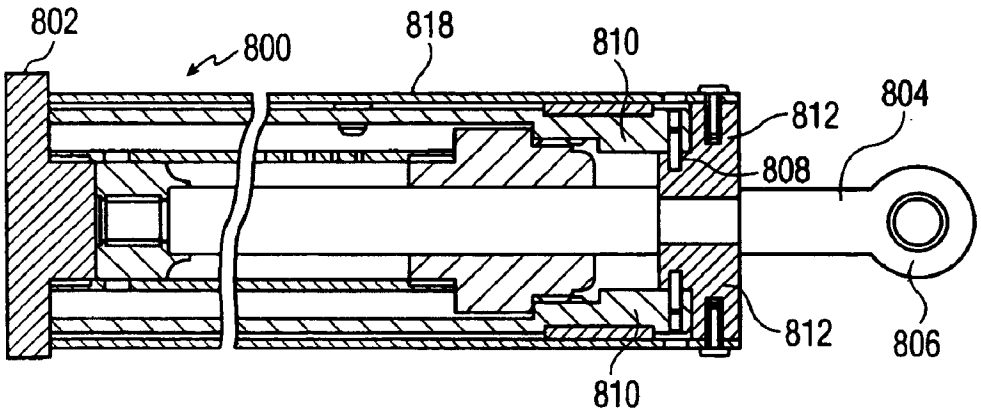
802
800
818
810
804
812
808
812
806
810

FIG. 9A

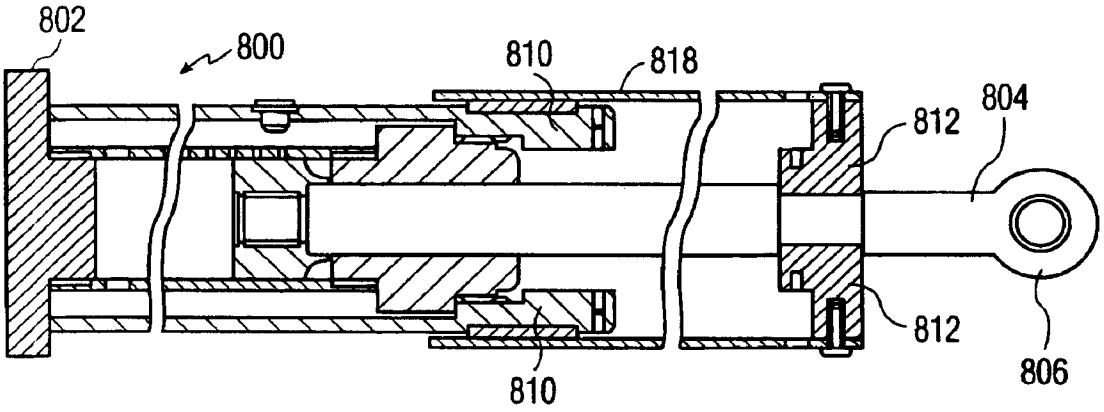
802
800
810
818
804
812
812
806
810

FIG. 9B

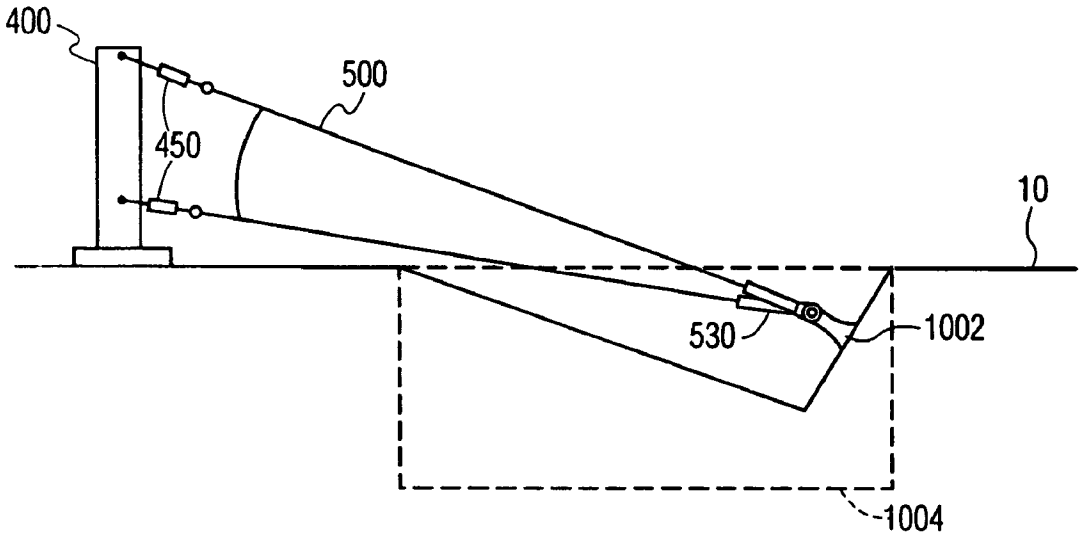

FIG. 10

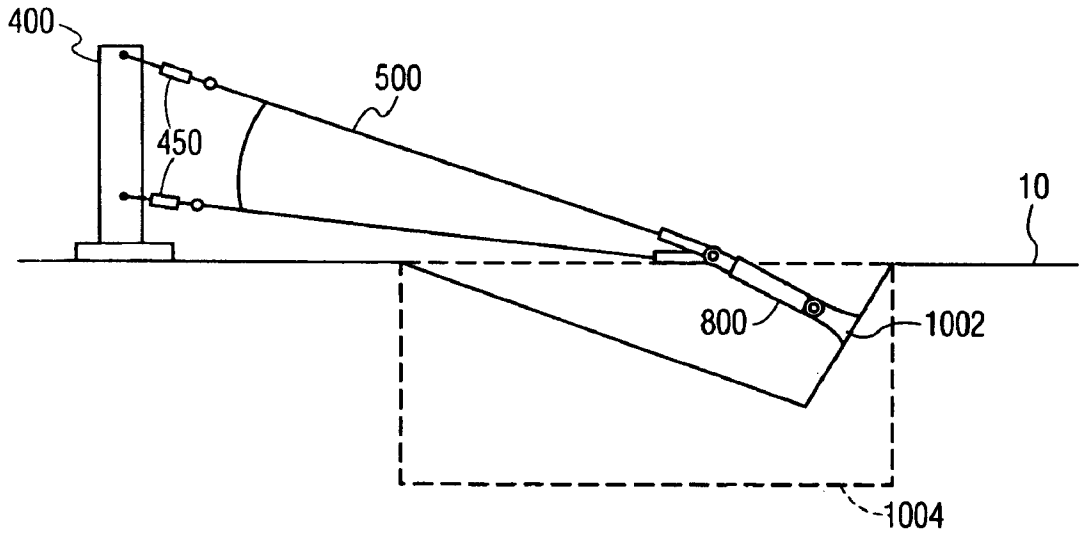

FIG. 11

ENERGY ABSORBING SYSTEM WITH SUPPORT

BACKGROUND

This invention relates to an energy absorbing system with a support where the system can be used to dissipate unwanted energy such as, e.g., the energy of an errant vehicle. The system may be used in a variety of applications, including HOV lane traffic control, drawbridges, security gates, or crash cushion applications. In one application, the system may be used to prevent a vehicle from crossing a railroad track while the warning gates are down or there is a train in the area.

SUMMARY OF THE DISCLOSURE

The present disclosure relates to an energy absorbing system. In one embodiment, the energy absorbing system includes an anchor, a net mechanically coupled to the anchor, and a support mechanically coupled to the net via a frangible connector, wherein the frangible connector uncouples the support from the net upon application of at least a threshold force to the frangible connector. The system may further include an energy absorber mechanically coupling the net and the anchor. The system may further include a joint mechanically coupling the energy absorber and the anchor, wherein the joint pivots on a horizontal axis.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view which illustrates an energy absorbing system with support arranged at a railroad crossing of a single-lane roadway according to one aspect of the system of the present disclosure.

FIG. **2** is a perspective view which illustrates an energy absorbing system with support arranged at a railroad crossing of a single-lane roadway and restraining a vehicle according to one aspect of the system of the present disclosure.

FIG. **3**A is a side view of a stanchion, joint, shock absorber and capture net according to one aspect of the system of the present disclosure.

FIG. **3**B is a side view of a stanchion and capture net according to one aspect of the system of the present disclosure.

FIG. **4**A is a front view of a support, breakaway device and capture net according to one aspect of the system of the present disclosure.

FIG. **4**B is a side view of a support according to one aspect of the system of the present disclosure.

FIG. **4**C is a side view of a support according to one aspect of the system of the present disclosure.

FIG. **5** is a front view of a capture net according to one aspect of the system of the present disclosure.

FIG. **6**A is a top view of a bearing sleeve clamp according to one aspect of the system of the present disclosure.

FIG. **6**B is a side view of a bearing sleeve clamp according to one aspect of the system of the present disclosure.

FIG. **7**A is a side view of a joint according to one aspect of the system of the present disclosure.

FIG. **7**B is a top view of a joint according to one aspect of the system of the present disclosure.

FIG. **8**A is a side view of a shock absorber in a compressed state according to one aspect of the system of the present disclosure.

FIG. **8**B is a side view of a shock absorber in an expanded state according to one aspect of the system of the present disclosure.

FIG. **9**A is a side view of a shock absorber in a compressed state according to one aspect of the system of the present disclosure.

FIG. **9**B is a side view of a shock absorber in an expanded state according to one aspect of the system of the present disclosure.

FIG. **10** is a side view which illustrates an energy absorbing system with support arranged at a roadway according to one aspect of the system of the present disclosure.

FIG. **11** is a side view which illustrates an energy absorbing system with support arranged at a roadway according to one aspect of the system of the present disclosure.

DETAILED DESCRIPTION

The energy absorbing system in one aspect may comprise an anchor or other mechanism for providing a fixed point, for example, a stanchion, one or more energy absorbing mechanisms coupled to the anchor for absorbing forces, a restraining capture net or other barrier coupled to one or more the energy absorbing mechanisms, and a support or other mechanism for supporting the restraining capture net or other barrier. In another aspect, the restraining capture net or other barrier may be coupled to the anchor without an energy absorbing mechanism between the restraining capture net and stanchion.

In another aspect, the support may be attached to the restraining capture net or other barrier via a frangible breakaway mechanism which breaks and thereby decouples the support and the restraining capture net in response to tensile forces that meet or exceed a minimum threshold force. In one aspect, it is envisioned that static tension from the restraining capture net in its quiescent state would not exceed this minimum threshold force, but that increased tension due to the dynamic forces exerted upon the frangible breakaway mechanism from a vehicle driving into the restraining capture net would exceed this minimum threshold force.

In another aspect, the support may be attached to the restraining capture net via a non-frangible connector and the support may be disturbed by the impact of the vehicle, or the non-frangible connector may expand or extend. In another aspect, the support may include a frangible or releasable portion, for example, a post, which decouples the support from the net in response to a minimum threshold force. In another aspect, the support may include a retractable mechanism for supporting the restraining capture net from above.

In yet another aspect, the support may be raised and lowered, thereby raising and lowering the restraining capture net or other barrier which it supports.

The energy absorbing mechanism may be mounted for rotation about the axis and be expandable in a direction substantially orthogonal to the axis. In another aspect, the energy absorbing mechanism may be a shock absorber, braking mechanism, or other friction damper, and may include a securing mechanism such that an expandable section of the energy absorbing mechanism, for example, a piston, does not expand except in response to tensile forces that meet or exceed a minimum threshold force. In one aspect, the static tension from the restraining capture net in its quiescent state will not exceed this minimum threshold force, and increased tension due to the dynamic tensile

forces exerted upon the shock absorber from a vehicle driving into the restraining capture net would exceed this minimum threshold force.

Referring to the drawings, wherein like reference numerals represent identical or corresponding parts throughout the several views, and more particularly to FIG. **1**, a general layout of an embodiment according to one aspect of the system of the present disclosure is shown installed at a railroad crossing. A roadway is indicated generally by reference numeral **10** and railroad tracks are indicated generally by reference numeral **20**. A capture net **500** is stretched across roadway **10** parallel to tracks **20**. Capture net **500** extends between anchors, for example, stanchions **300**, and supports **400** located on opposite sides of roadway **10**. The capture net **500** may be coupled at each end to a braking mechanism, for example, shock absorbers **800** which in turn may be coupled to a joint **700**, which may be coupled to a bearing sleeve **330** surrounding stanchion **300**, as described in greater detail below.

In FIG. **1**, the shock absorbers **800** are substantially parallel to roadway **10**, and shock absorber pistons **804** are in a compressed state. In this aspect, the supports **400** are arranged with respect to stanchions **300** in a manner such that, on impact, the pistons **804** may extend in a direction substantially the same as the direction in which the vehicle **30** is traveling.

The capture net **500** may be coupled to supports **400** via a breakaway connector **450**. The supports **400**, which may be raised and lowered, are shown in a raised position in FIGS. **1** and **2**. When supports **400** are lowered, the capture net **500** may rest in a position such that vehicles may drive over the capture net **500** unimpeded. In another aspect, when supports **400** are lowered, capture net **500** may be tucked into, for example, a slot cutout spanning roadway **10**, and having sufficient depth and width to accommodate some or all of the capture net **500**; such a cutout may be incorporated into a speed-bump.

Shown at the top of FIG. **2** is a vehicle **30** which has crashed into capture net **500** and is restrained by capture net **500** to prevent it and its occupants from encroaching onto tracks **20**. Capture net **500** has been deflected by the collision from its quiescent state so as to form a shallow "V" shape. Bearing sleeve **330** has rotated about stanchion **300** and shock absorbers **800** are now pointed inward toward roadway **10**, with shock absorber pistons **804** no longer in a compressed state. Joints **700** may pivot vertically depending on certain factors such as, for example, the height of the vehicle impact with capture net **500**. Further, breakaway connectors **450** have been severed, and, therefore, supports **400** no longer support capture net **500**.

The ability of capture net **500** to be deflected, yet provide a restraining force, allows vehicle **30** to be progressively stopped, thereby lessening adverse effects of the impact forces acting on vehicle **30** and its occupants. The deflecting and restraining functions are achieved by a unique energy absorbing system, described in greater detail below.

FIG. **3A** is a side view of a stanchion, joint, shock absorber and capture net according to one aspect of the system. Stanchion **300** may include a pipe **302**, which may be reinforced by inserting, a bar or other support (not shown) therein, may be filled with concrete (not shown) and embedded into a concrete base **320**, which has been poured into the ground. Stanchion **300** has an axis **310**, which may be a vertical axis, whose function will become clear hereinafter.

The system of the present disclosure may also include a bearing sleeve **330** fitted around stanchion **300** and which may be rotatable about stanchion **300**. Bearing sleeve clamps **600** fitted around stanchion **300** may be used to prevent bearing sleeve **330** from sliding vertically on stanchion **300**. Bearing sleeve **330** and bearing sleeve clamps **600** may be fabricated from pipe having approximately the same inner diameter as the outer diameter of stanchion **300**.

An example of a bearing sleeve clamp **600** according to one aspect of the system of the present disclosure is shown in FIGS. **6A** (top view) and **6B** (side view). As shown in FIGS. **6A** and **6B**, bearing sleeve clamp **600** may include a sleeve clamp ring **602** attached to a sleeve clamp flange **604** for securing about stanchion **300**. Sleeve clamp flange **604** may contain one or more holes **606** for accommodating one or more bolts or other securing mechanisms.

Returning to FIG. **3A**, stanchion **300** may be coupled to capture net **500** via shock absorber **800** and joint **700**. Accordingly, cable ends **530** of top cable **510** and bottom cable **520** may be coupled to piston connectors **806**, using a pin or other mechanism. Shock absorber **800** may have a shock absorber flange **802** which may be secured using bolts to joint front flange **702**. Joint rear flange **720** may be secured to bearing sleeve **330**, by a weld, bolts or other means to a bearing sleeve flange (not shown) coupled to bearing sleeve **330**. Alternatively, joint **700** may be omitted, with shock absorber flange **802** secured to bearing sleeve **330**, by a weld, bolts or other suitable means, to the bearing sleeve flange.

In another aspect, a crossbar **900** may be attached vertically between two or more cables, joints **700**, or shock absorbers **800** arranged on a stanchion **300**. The crossbar **900** may alleviate vertical torque on the cables, joints **700** and shock absorbers **800**, which might otherwise occur due to the fact that a vehicle **30** colliding with the capture net **500** may cause the top cable **510** and bottom cable **520** and, therefore, the joints **700** and shock absorbers **800** connected thereto, to tend to squeeze together. Thus, the crossbar **900** may act as a stabilizer against this vertical torque. The crossbar **900** may also cause top and bottom pistons **804** to expand with increased uniformity upon impact by vehicle **30**. In one aspect, the crossbar **900** may be formed of a rigid material such as, for example, steel or other hard metal. In another aspect, crossbar **900** may be constructed of non-rigid material, for example, cable.

FIG. **3B** shows a side view of a stanchion and capture net according to another aspect of the system of the present disclosure. In this aspect, shock absorbers **800** are not present, and cable ends **530** may be coupled to the stanchion **300** or bearing sleeve **330**. In other aspects, cable ends **530** may be coupled to joint front flange **702**, or joint inner prongs **722** using pin **712**. In each of these aspects, because shock absorbers **800** are not present, vehicle **30** will come to a halt in a shorter distance with greater deceleration. In these aspects, capture net **500** may be constructed of cable having a greater strength than in a system in which shock absorbers **800** are present.

FIGS. **4A** (front view), **4B** (side view) and **4C** (side view) show a support **400** according to one aspect of the system of the present disclosure. As shown in FIGS. **4A** and **4B**, the support **400** may include a post **402**, which may include top cable securing point **404** for attaching, for example, a breakaway connector **450** to top cable **510**, and bottom cable securing point **406** for attaching, for example, a breakaway connector **450** to bottom cable **520**.

Post **402** may be inserted into a spool **426** around which a spring **424** is coiled in a manner such that in the spring's uncompressed state, post **402** is in an upright, vertical position as shown in FIGS. **4A** and **4B**. Post **402** may pivot with the spool **426** in the direction shown by arrow **430**.

Spring **424** and spool **426** may be encased in housing **410** which may include top plate **412**, base plate **414**, and side plates **420**, as well as back plate **418** and back support **422**. Post **402** may also include securing point **408** which may be used by a raise-lowering mechanism (not shown). Post **402** may also include a hook or other device (not shown) for connecting to a latching mechanism which may be placed on the ground or incorporated as part of an extension of housing **410** and which secures the post **402** when the spring **424** is in a compressed state.

In another aspect, a levered system or a powered drive system, for example, an electric motor, located within or external to housing **410** may be used in place of the spring-based system described above.

As shown in FIG. **4**C, post **402** may have a raised and lowered position. Support **400** may be positioned such that, in the lowered position, the distal end of post **402**, i.e. that end not in contact with spool **426**, is pointed in the direction of oncoming vehicle **30**.

As described above, breakaway connector **450** disconnects the support **400** and the capture net **500** in response to forces that meet or exceed a minimum threshold force. In one aspect, static tension from the capture net **500** in its quiescent state would not exceed this minimum threshold force, but increased tension due to the dynamic tensile forces exerted upon the breakaway connector **450** from a vehicle **30** driving into the capture net **500** would exceed this minimum threshold force.

An eyebolt—turnbuckle—cable—clamp combination may be used to couple support **400** to capture net **500** and act as breakaway connector **450**. The eyebolt may connect to top cable securing point **404**. The eyebolt then may be coupled to an adjustable turnbuckle which may control the height and/or tension of capture net **500** when the support **400** is in the upright position. The other end of the adjustable turnbuckle may by coupled to a cable, for example, a 5/16 inch cable, which couples to a cable clamp attached to capture net **500**. It may be expected that at least the 5/16 inch cable will break, thereby disconnecting turnbuckle and cable clamp, when the minimum threshold force is exceeded. It will be apparent to one skilled in the art that, according to this aspect of the system of the present disclosure, the type, style and thickness of breakaway connector **450** used will depend on a number of factors, including, but not limited to, the type of capture net **500** and the amount of static tension applied to capture net **500** in its quiescent state.

Breakaway connector **450** and surrounding equipment may also include one or more of the following, alone or in combination: a turnbuckle, cable, come-along, bolt, or other frangible connection device. It will be apparent to one skilled in the art that a mechanism may be used for both its tensioning and frangible properties.

The raise-lowering mechanisms controlling post **402** may be under the control of a standard train-detecting system, such as is commonly used to control gates at railroad crossings. In operation, a control system (not shown) may sense the presence of an oncoming train and may thereby control capture net operations. In addition to railroad crossings, the system can also be used in a variety of other applications, including HOV lane traffic control, drawbridges, security gates, or crash cushion applications. One can readily appreciate that the control system for such applications may differ from that used in a railroad crossings. At security gates, for example, the capture net **500** may be in a raised position, and actuation of the security system (e.g., by a guard, a key card, keyboard punch, etc.) would lower the barrier and permit passage. In another application, the capture net **500** may be in a lowered position and raised when warranted, for example, in an emergency.

In another aspect, the support **400** may be attached to the restraining capture **500** net via a non-frangible connector. In this aspect, the non-frangible connector will not uncouple the support **400** from the capture net **500** in response to the threshold force. In one such aspect, the support **400** may be disturbed by the impact of the vehicle **30**. In another aspect, the support **400** may be integrated into the net **500**. In another aspect, the non-frangible connector may expand or extend in response to a threshold force. In another aspect, the non-frangible connector may compress in response to a threshold force.

In yet another aspect, the support **400** may include a frangible or releasable portion, for example, the post **402** may decouple the support **400** from the capture net **500** in response to a minimum threshold force.

In another aspect, the support **400** may include a retractable mechanism (not shown) for supporting the restraining capture net **500** from above.

FIG. **5** shows a capture net **500** which includes a top cable **510** and bottom cable **520**, each having cable ends **530**, where the top cable **510** and bottom cable **520** may be coupled by a number of vertical cables **540**. The vertical cables **540** may be coupled by a center cable **550**.

Vertical cables **540** may be coupled to center cable **550**, for example, by using a u-bolt, or the two may be interwoven. In another aspect of the system of the present disclosure, the vertical cables **540** may be, for example, woven into the top cable **510** and bottom cable **520**. Other suitable nets may be used.

FIGS. **7**A and **7**B show side and top views, respectively, of joint **700** according to one aspect of the system of the present disclosure. A prong stop plate **706**, may make contact with joint rear flange **720** to support the weight of the capture net **500** and shock absorber **800** and may prevent joint front flange **702** from pivoting downward beyond a predetermined level, for example, a horizontal level. Joint outer prongs **708** may be supported by joint outer prong supports **710** which attach to joint front flange **702** and fit on either side of joint inner prongs **722**. Joint inner prongs **722** attach to joint rear flange **720** and may be supported by joint inner prong support **724**. Joint outer prongs **708** and joint inner prongs **722** may be rotatably fixed using a pin **712**, thereby allowing shock absorber **800** to pivot on a vertical plane. Joint front flange **702** may have bolt holes **704** for securing to shock absorber flange **802**.

FIGS. **8**A and **8**B show a side view of a shock absorber in a compressed state and expanded state, respectively. Shock absorber **800** has shock absorber flange **802** which may couple to joint front flange **702**.

Shock absorber piston **804** may be removably attached to capture net **500** via a piston connector **806**, which may be an eyelet extension, through which a cable, clamp or other appropriate securing mechanism may be passed in order to secure the cable end **530** to the shock absorber piston **804**.

Prior to vehicle **30** colliding with capture net **500**, shock absorber **800** may be in a compressed state and may be secured by a threshold force securing mechanism. The threshold force securing mechanism may be capable of withstanding a predetermined threshold tensile force. In one aspect, a threshold force securing mechanism includes one or more shear pins **808** which may be inserted through a shear pin collar **810** into a shear pin ring **812**. A number of shear pins **808**, for example, four, may be arranged radially about the longitudinal axis of shock absorber **800**. The shear pin collar **810** may be integral or separate from other parts

of the shock absorber. The shear pin **808** may be a self-setting screw type pin or shear pin **808** optionally may be secured by a set screw **814**. Other threshold force securing mechanisms can be used in combination with, or instead of, a shear pin. For example, a securing mechanism such as a brake pad, a counterweight, or other counter-force may be used. The threshold force securing mechanism allows the shock absorber **800**, without expanding from its compressed state, to assist the support **400** in pulling capture net **500** taut. The shock absorber **800** on the other side of roadway **10**, in an identical configuration, will assist the other corresponding support **400** in pulling the other side of the capture net **500** taut.

Capture net **500** may be installed with a pre-tension horizontal load, for example, 1,000–20,000 pounds, on its cables. This load will depend on a number of factors including, but not limited to, the length of capture net **500**, the desired height of capture net **500**, and construction and materials of the capture net **500**.

When a vehicle **30** collides with capture net **500**, the vehicle deflects the capture net **500**, causing it to exert a tensile force exceeding the minimum threshold force upon shock absorber **800**. When the threshold force securing mechanism includes shear pins **808**, the tensile force causes the shear pins **808** to shear and thereby permits the expansion of piston **804** of shock absorber **800** against the resistance of the hydraulic fluid in cylinder **816** (FIG. **8**B). Shock is thereby absorbed during its expansion, while the force of the capture net **500** may rotate shock absorber **800** and bearing sleeve **330**, and may cause joint **700** to pivot about a horizontal axis. Forces applied upon capture net **500** are thereby translated through the center of stanchion **300**, which is solidly anchored in foundation **320**. Therefore, energy may be distributed among and absorbed by capture net **500**, the shock absorbers **800**, joint **700** and the stanchion **300**.

The shock absorbing mechanism may alternatively include a torque protection structure as illustrated in FIGS. **9**A and **9**B, which show side views in a compressed and expanded state, respectively. According to this aspect, shock absorbers **800** include a protective sleeve **818** which may be coupled to and travel with piston **804** in order to add structural strength to resist deformation of the housing or other parts of the shock absorber **800** due to the torque that the capture net **500** exerts upon capturing a vehicle and deflecting shock absorbers **800**. The protective sleeve **818** may be made of any suitable structural material, for example, aluminum or steel.

FIG. **10** is a side view which illustrates an energy absorbing system with support **400** arranged at a roadway according to one aspect of the system of the present disclosure. Net **500** is connected to an anchor, for example, a tie back **1002**, which may be located above, at, or below ground level. In the aspect shown, cable ends **530** of top cable **510** and bottom cable **520** are each coupled to tie back **1002** which is embedded below ground level in concrete **1004** alongside roadway **10**. In another aspect, each of top cable **510** and bottom cable **520** may be coupled to a separate tie back **1002**. In another aspect, tie back **1002** may be coupled to net **500** via a socket (not shown).

FIG. **11** is a side view which illustrates an energy absorbing system with support **400** arranged at a roadway according to one aspect of the system of the present disclosure. Net **500** is coupled to a shock absorber **800** which is coupled to an anchor, for example, a tie back **1002**, which may be located above, at, or below ground level. In the aspect shown, cable ends **530** of top cable **510** and bottom cable **520** are each coupled to shock absorber **800** which is coupled to tie back **1002** which is embedded below ground level in concrete **1004** alongside roadway **10**. In another aspect, each of top cable **510** and bottom cable **520** may be coupled to any combination of shock absorbers **800** and tie backs **1002**.

An embodiment similar to that shown in FIGS. **1** and **2** was constructed as follows. It will be apparent to one skilled in the art that size and thickness of the materials used will vary based on, for example, the expected potential energy encountered by the system, determined by such factors as the expected size and velocity of the vehicles to be arrested.

The overall width of the installation was 12 feet centerline to centerline of the stanchions **300**. The capture net **500** width was 25 feet, and included top cable **510**, bottom cable **520** and center cable **550** spaced 1.5 feet apart and coupled by seven vertical cables **540** spaced 1.5 feet apart. The uninstalled constructed capture net **500** height was 3 feet. The height of the capture net **500** when installed and tensioned was 50.25 inches to the center of the top cable and 15.75 inches to the center of the bottom cable as measured at the centerline of the capture net **500**. The top cable **510** and bottom cable **520** were 1.25 inch 6×26 galvanized MBL 79 tons, the vertical cables **540** and center cable **550** were ⅝ inch 6×26 galvanized MBL 20 tons, and the vertical cables **540** were coupled to the top cable **510** and bottom cable **520** by swage sockets. Cable ends **530** were also swage sockets.

Cable ends **530** of top cable **510** and bottom cable **520** were coupled to the stanchion **300** via shock absorber **800**, joint **700** and bearing sleeve **330** at points 2 feet 10 inches and 1 feet 7 inches as measured from ground level to the cable center point, respectively.

In an aspect where shock absorbers **800** are not present, top cable **510** and bottom cable **520** may be, for example, 1.5 inch thickness, and center cable **550** and vertical cables **540** may be ¾ inch thickness.

In another aspect a 50 foot capture net **500** may be used for a 36 foot distance between stanchions **300**, which may include top cable **510**, bottom cable **520** and center cable **550** spaced 1.5 feet apart coupled by twenty-three vertical cables **540** spaced 1.5 feet apart.

The supports **400** were located 13 feet in front of, and 3 feet to the outside of the stanchions **300**, with a pole **402** height of 4 feet 8 and ⅝ inches and top securing height of 4 feet 7 inches and bottom securing height of 1 feet 8 inches.

Concrete base size may vary by installation and application. In the embodiment constructed, the hole used for the concrete base **320** was measured as 15 feet in direction vehicle **30** was traveling, 27 feet between stanchions **300** and 3.5 feet deep.

The spring **424** used had 1000 ft lbs torque, an inner diameter of 9 inches and an outer diameter of 11 inches. Joint front flange **702** included four holes for bolting to shock absorber flange **802**. Joint rear flange **720** was welded to bearing sleeve **330**. Pin **712** had a length of 10 and ¾ inches and diameter of 2 and ⅜ inches.

The shock absorbers **800** used were hydraulic with about a 130,000 pound resistance with a 36 inch stroke and had an accumulator with a 5,000 pound return force for use with a 15,000 pound, 50 mph vehicle impact. The length of shock absorber **800** was 97 inches extended and 61 inches compressed, with a diameter of 10.8 inches.

Stanchion **300** included a 2 inch thick steel pipe, which had a 16 inch outside diameter and was 94 inches long. The stanchion **300** was reinforced by inserting a 4 inch thick steel bar, which had a width of 11.3 inches and length of 94 inches. Stanchion was filled with concrete and was embed-

ded approximately 3.5 feet deep below ground level and extended approximately 3.8 feet above ground level.

Bearing sleeve **330** was 31" long. Bearing sleeve clamp **600** had an outside diameter of 18 inches. Sleeve clamp flange **604** included two holes **606** to accommodate two bolts for tightening about stanchion **300**. Bearing sleeve clamp **600** had an inner diameter of 16 inches and was fabricated of the same material as bearing sleeve **330**.

Numerous additional modifications and variations of the present disclosure are possible in view of the above-teachings. It is therefore to be understood that within the scope of the appended claims, the present disclosure may be practiced other than as specifically described herein.

What is claimed is:

1. An energy absorbing system comprising:

an energy absorber mechanically coupled to a net;

a joint mechanically coupled to the energy absorber;

a sleeve rotatably mechanically coupled to an anchor and mechanically coupled to the joint; and

a support mechanically coupled to the net via a frangible connector,

wherein the frangible connector uncouples the support from the net upon application of at least a threshold force to the frangible connector, and wherein the joint pivots on a horizontal axis and supports the energy absorber at a predetermined angle relative to ground level.

2. The energy absorbing system of claim **1**, wherein the predetermined angle is substantially parallel to ground level.

3. The energy absorbing system of claim **1**, wherein the joint includes a stop plate preventing the joint from pivoting beyond the predetermined angle.

4. The energy absorbing system of claim **1**, wherein the sleeve is substantially vertically fixed relative to the anchor.

5. The energy absorbing system of claim **1**, further comprising a tensioning device mechanically coupling the frangible connector and one of the net and the support.

6. The energy absorbing system of claim **5**, wherein the frangible connector and tensioning device are combined into a single device.

7. The energy absorbing system of claim **1**, further comprising:

a second energy absorber mechanically coupled to a lower portion of the net and arranged below the energy absorber; and

a second joint mechanically coupled to the second energy absorber and mechanically coupled to the sleeve,

wherein the second joint pivots on a horizontal axis and supports the second energy absorber at a predetermined angle relative to ground level.

8. A method for absorbing the energy of an errant vehicle, comprising:

positioning a net across an area through which the vehicle is expected to pass, the net being mechanically coupled to an energy absorber, which is mechanically coupled to a joint, which is mechanically coupled to a sleeve, which is rotatably mechanically coupled to an anchor; and

mechanically coupling the net to a support through a frangible connector,

wherein the frangible connector uncouples the support from the net upon application of at least a threshold force to the frangible connector by the vehicle and the force of the vehicle is transferred through the net to the anchor, and

wherein the joint pivots on a horizontal axis and supports the energy absorber at a predetermined angle relative to ground level.

9. An energy absorbing system comprising:

means for absorbing energy;

means for restraining a vehicle, the restraining means being connected to the energy absorbing means to enable the transfer of energy from a vehicle impacting the restraining means to the energy absorbing means;

means for permitting the restraining means to rotate about the energy absorbing means;

means for pivoting the restraining means on a horizontal axis and supporting the energy absorbing means at a predetermined angle relative to ground level; and

means for supporting the restraining means in a position likely to be impacted by the vehicle until the application of at least a threshold force by the vehicle to the restraining means.

10. An energy absorbing system comprising:

an energy absorber mechanically coupled to a net;

a joint mechanically coupled to the energy absorber;

a sleeve rotatably mechanically coupled to an anchor and mechanically coupled to the joint; and

a support having a base mechanically coupled to a post mechanically coupled to the net,

wherein the post uncouples from the base upon application of at least a threshold force to the net, and wherein the joint supports the energy absorber at a predetermined angle relative to ground level.

* * * * *

Exhibit 5

US007195419B2

(12) **United States Patent**
Gelfand

(10) **Patent No.: US 7,195,419 B2**
(45) **Date of Patent: Mar. 27, 2007**

(54) **NET AND MAT**

(75) Inventor: **Matthew A. Gelfand**, Rockville Centre, NY (US)

(73) Assignee: **Universal Safety Response, Inc.**, New York, NY (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 195 days.

(21) Appl. No.: **11/095,240**

(22) Filed: **Mar. 31, 2005**

(65) **Prior Publication Data**

US 2005/0218391 A1 Oct. 6, 2005

Related U.S. Application Data

(60) Provisional application No. 60/557,868, filed on Mar. 31, 2004.

(51) **Int. Cl.**
E01F 13/00 (2006.01)
E01F 13/02 (2006.01)

(52) **U.S. Cl.** **404/6**; 404/9

(58) **Field of Classification Search** 404/6, 404/9

See application file for complete search history.

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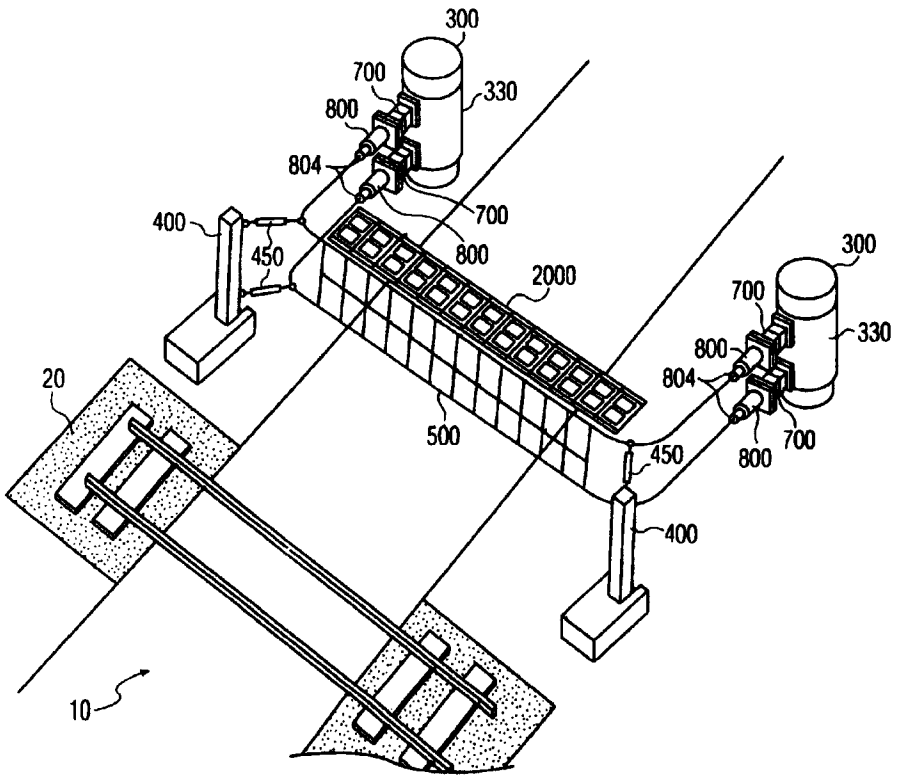
Primary Examiner—Raymond Addie
(74) *Attorney, Agent, or Firm*—Milbank Tweed Hadley & McCloy LLP

(57) **ABSTRACT**

An energy absorbing system. The energy absorbing system spanning a roadway and including a net spanning the roadway, the net having a connecting member coupled to a top member, a middle member and a bottom member, and a mat arranged on the roadway, having a plurality of recesses to accommodate the net, when the net is in a lowered position.

12 Claims, 16 Drawing Sheets



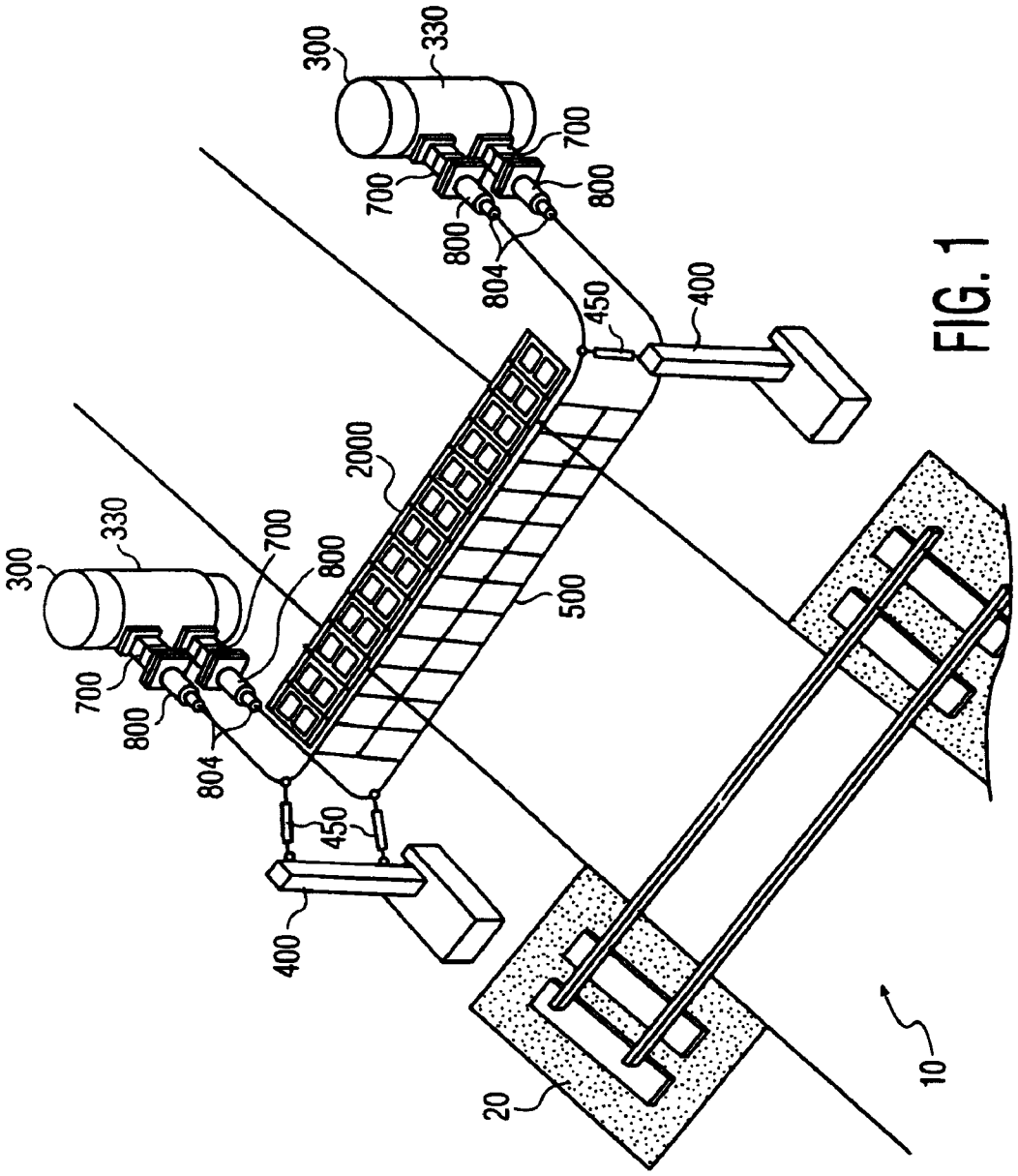


FIG. 1

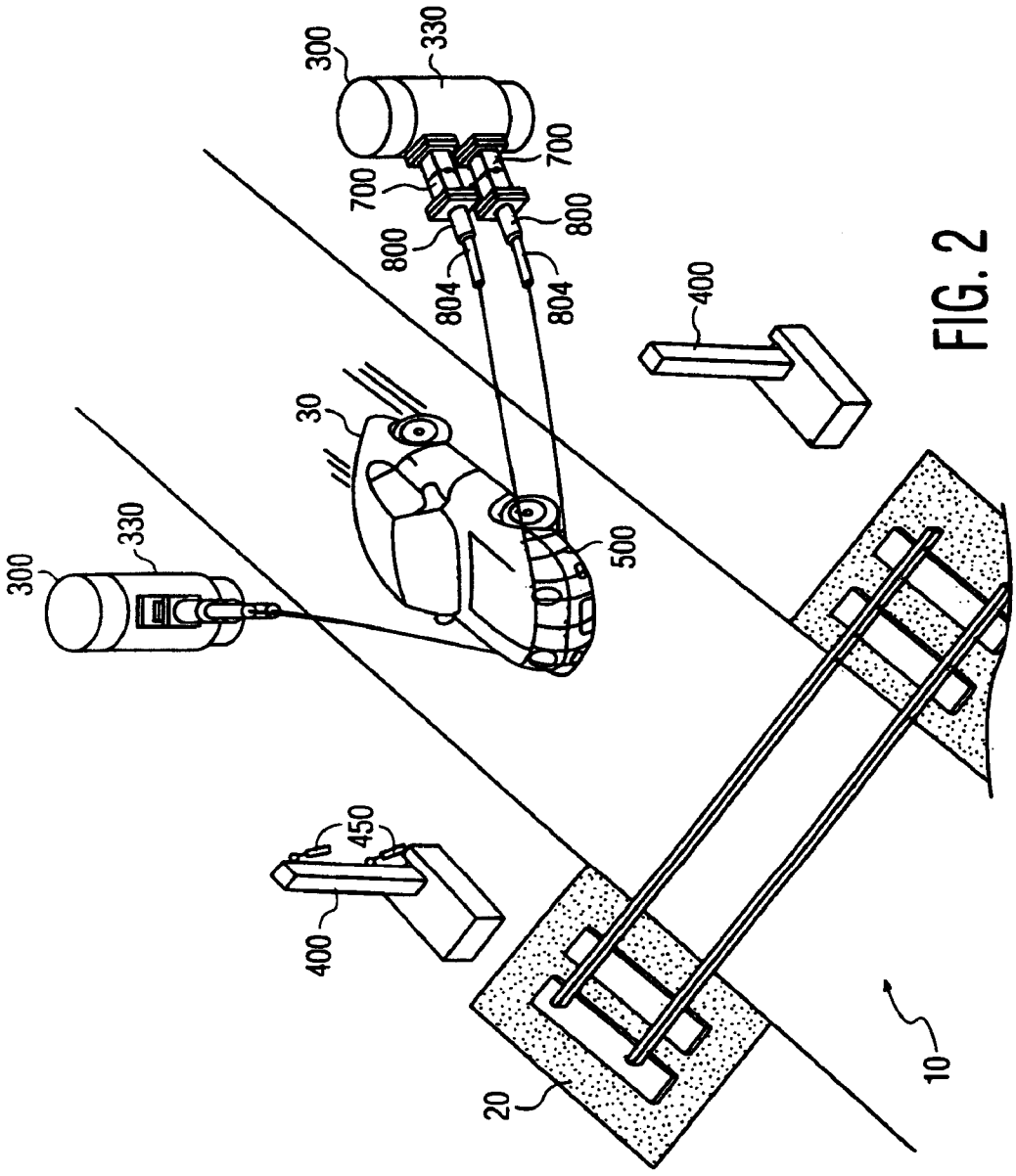
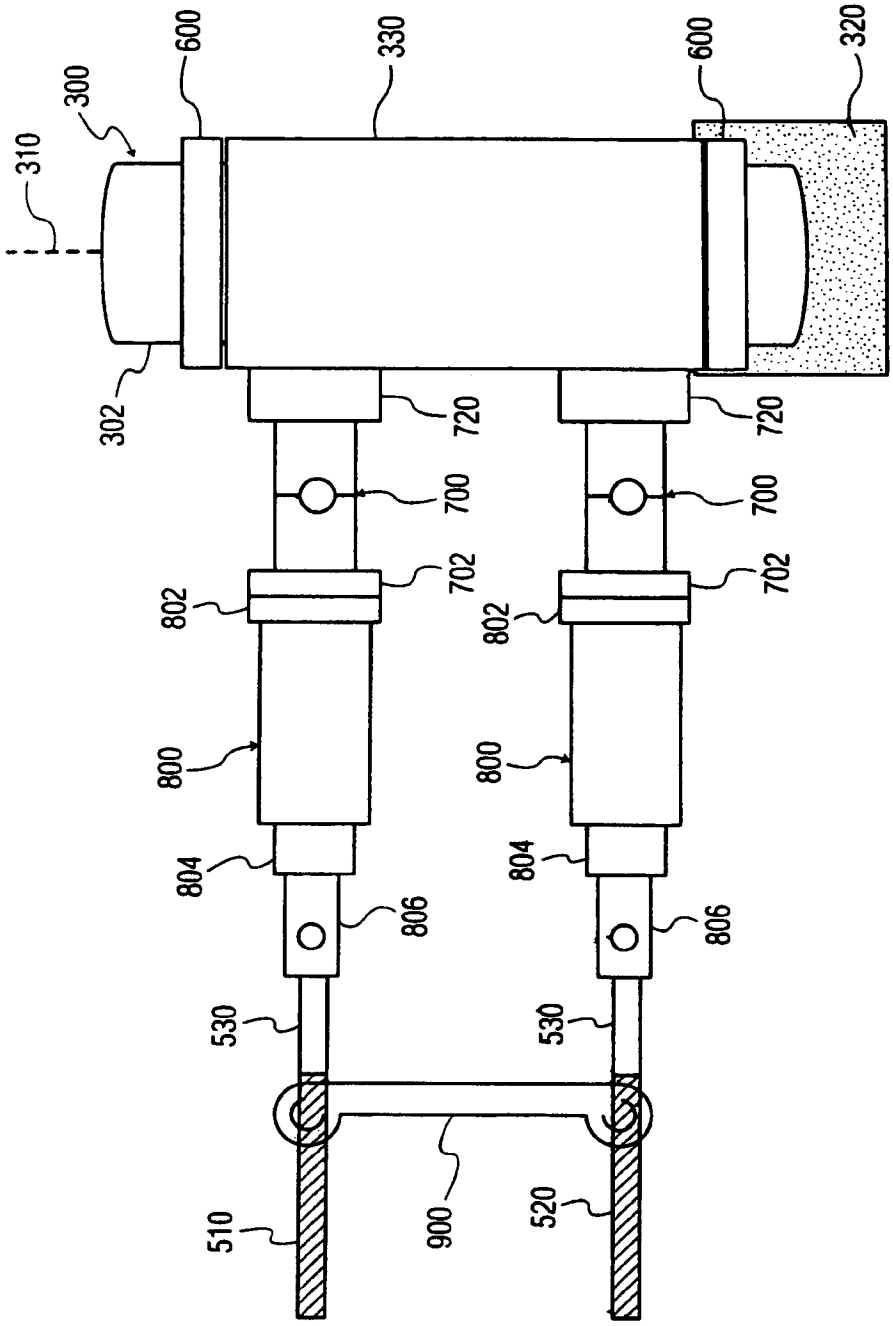


FIG. 2


600
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320
300
310
302
720
720
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702
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802
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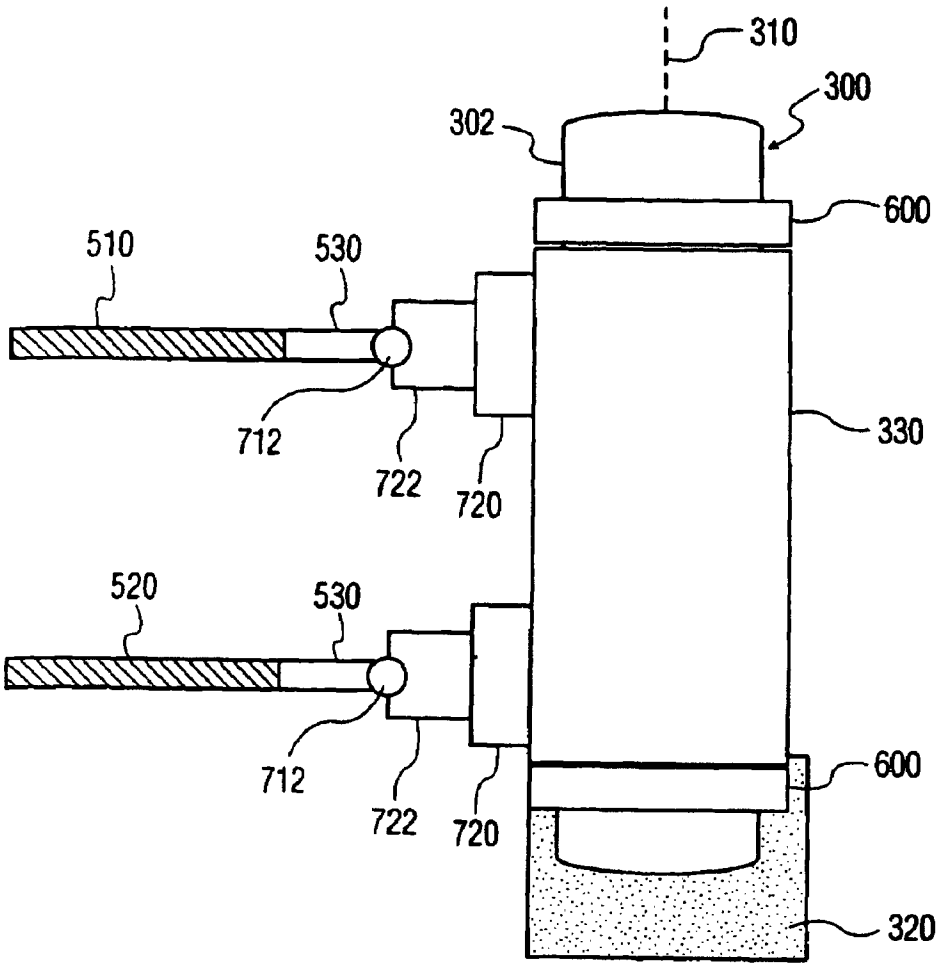
806
806
530
530
510
900
520

FIG. 3A


310
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302
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510
530
712
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320

FIG. 3B

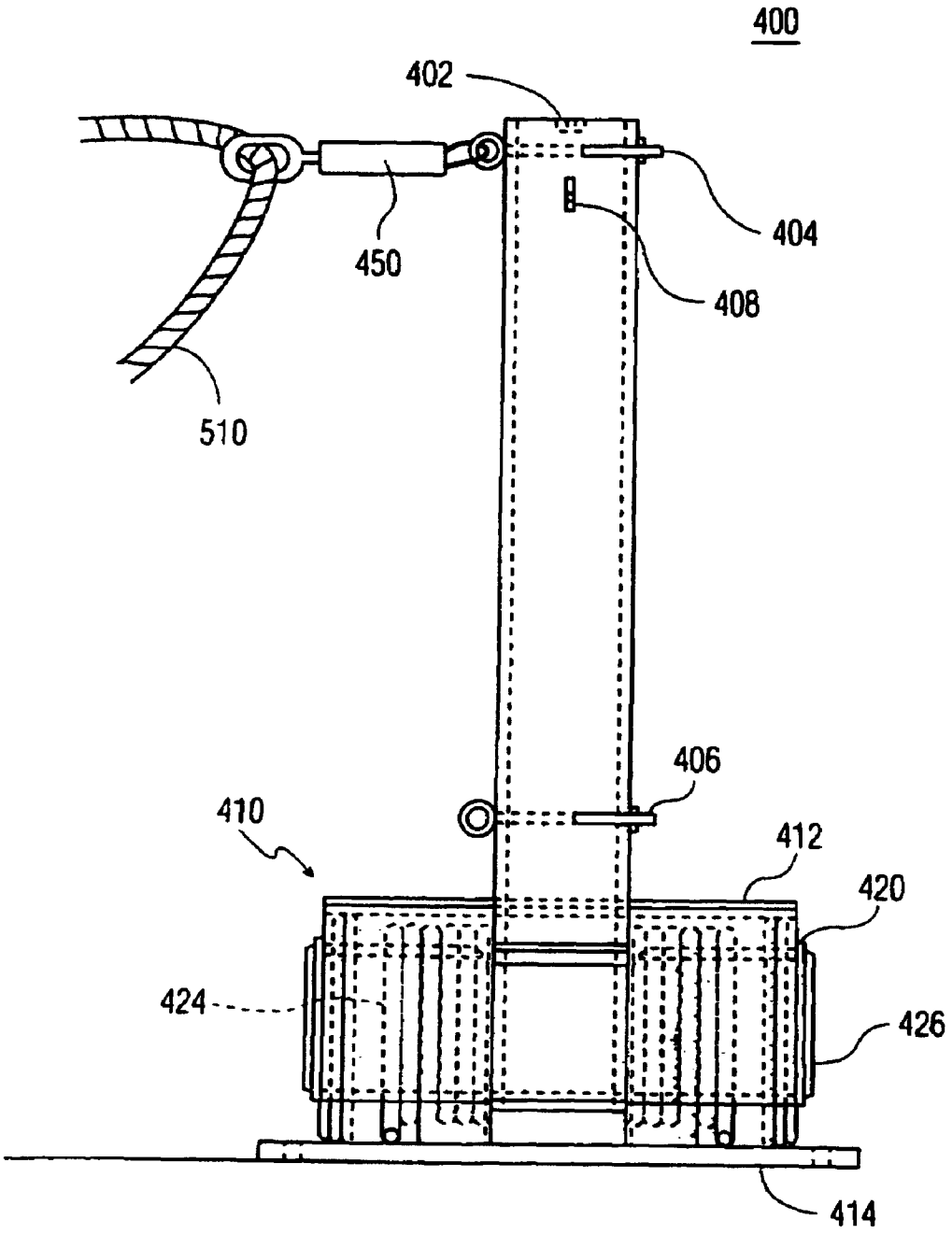

FIG. 4A

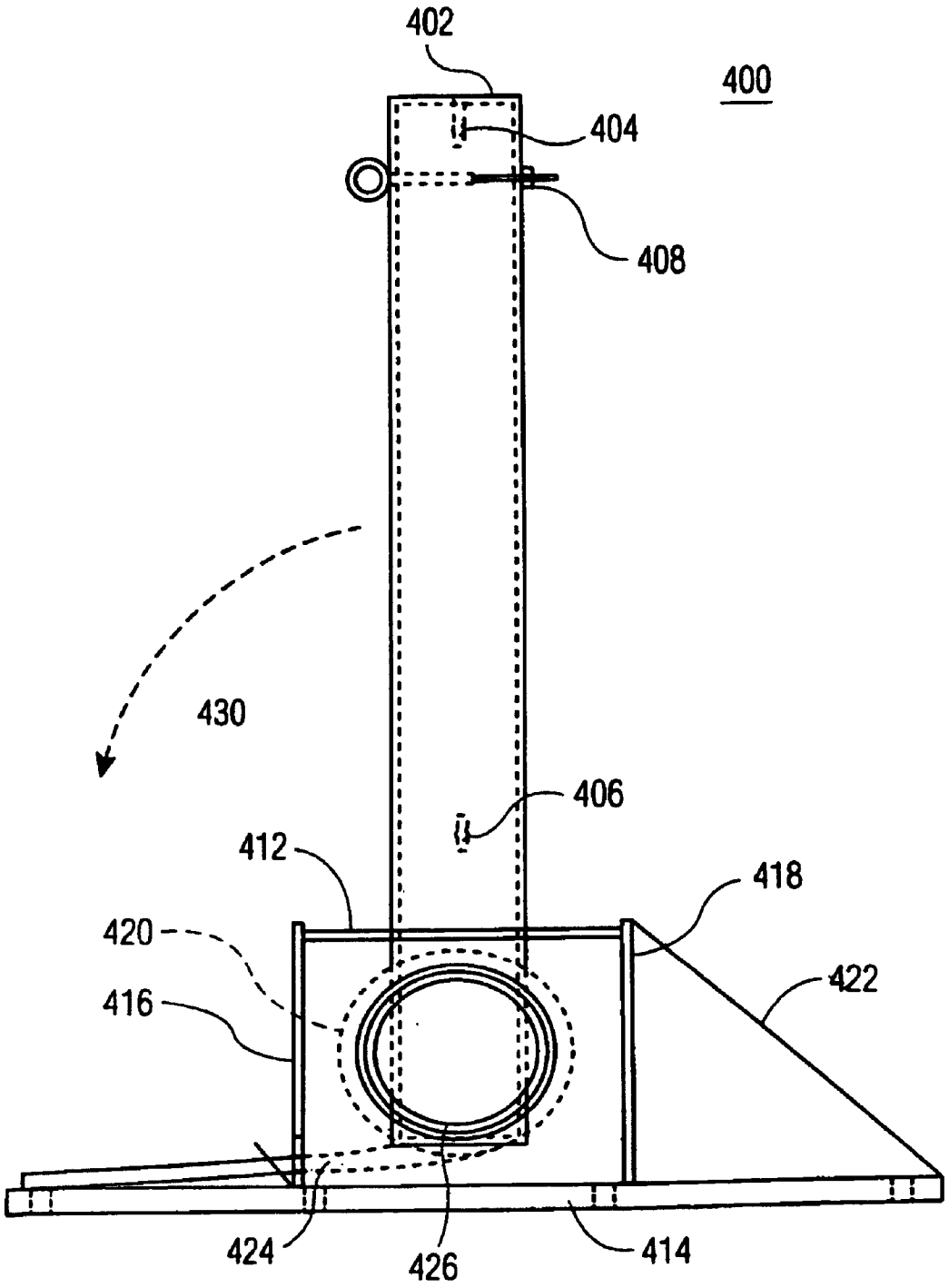

FIG. 4B

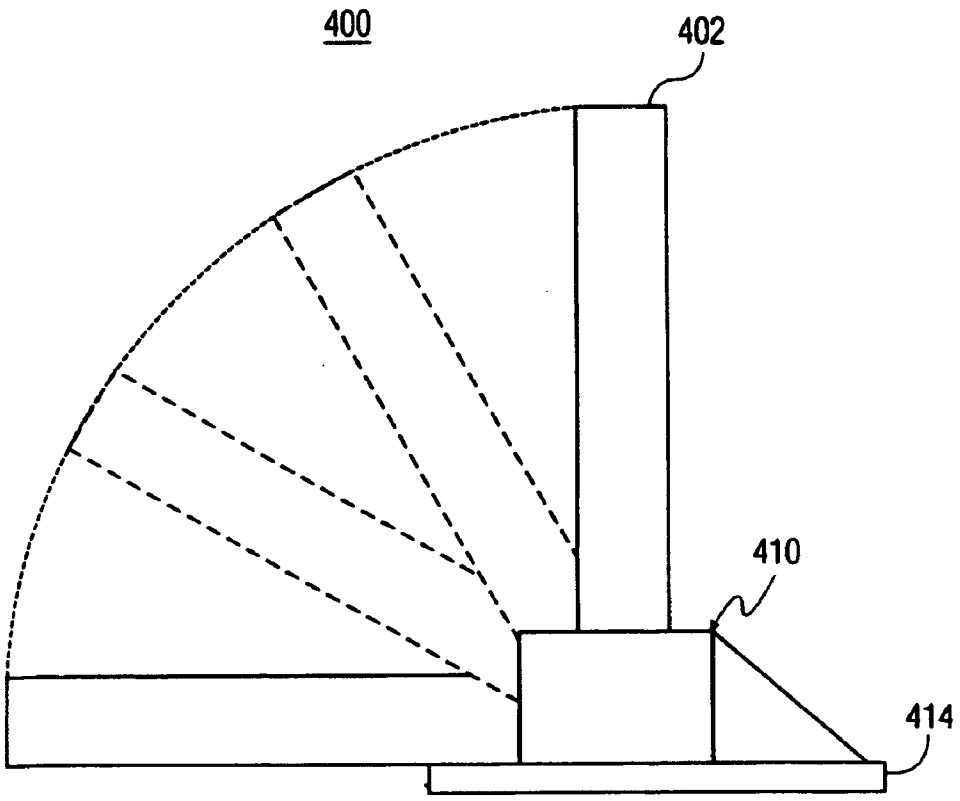

FIG. 4C

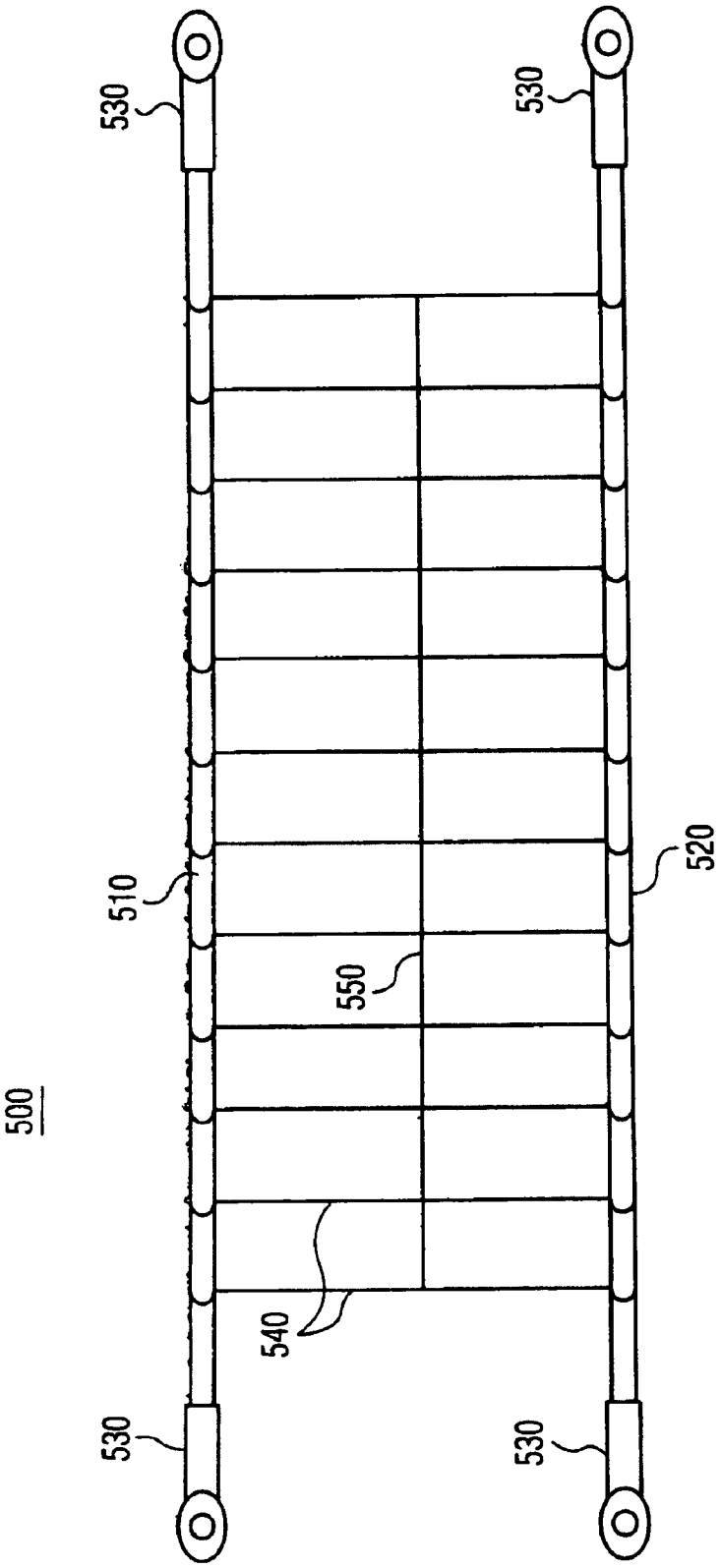

FIG. 5

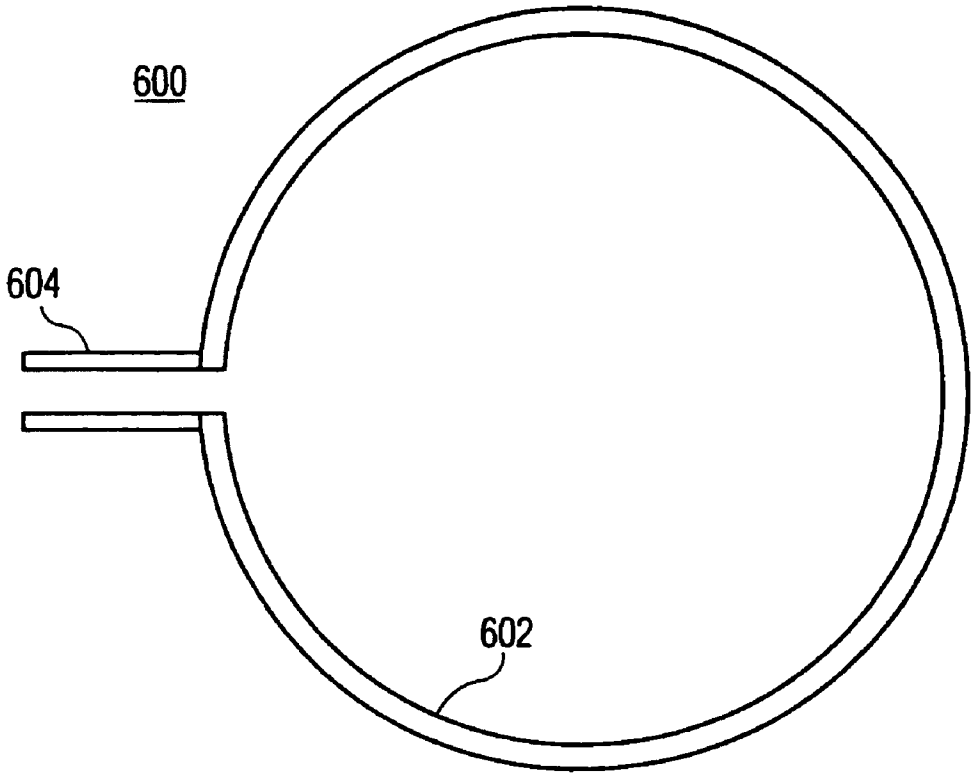

FIG. 6A

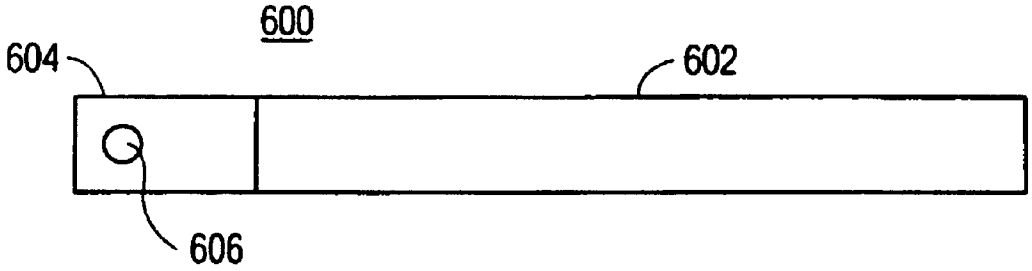

FIG. 6B

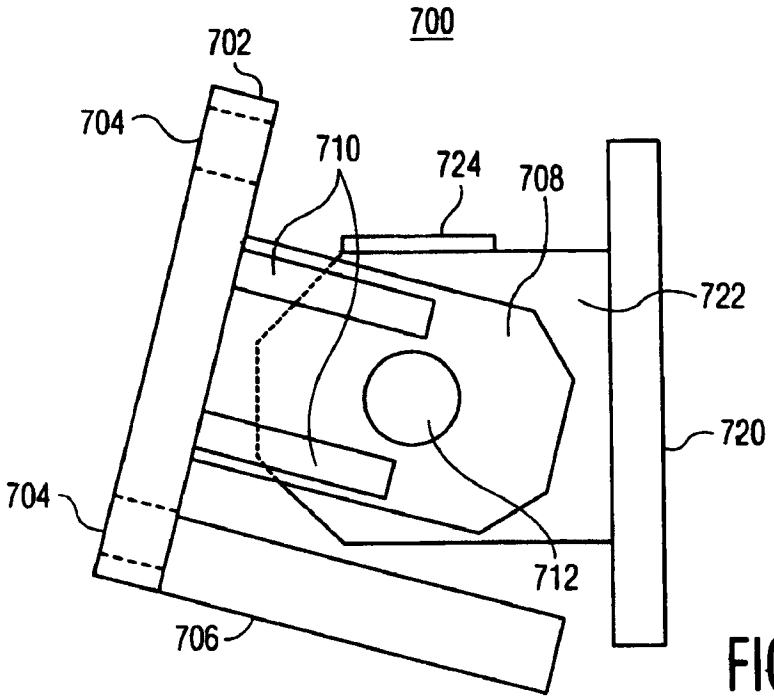
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FIG. 7A

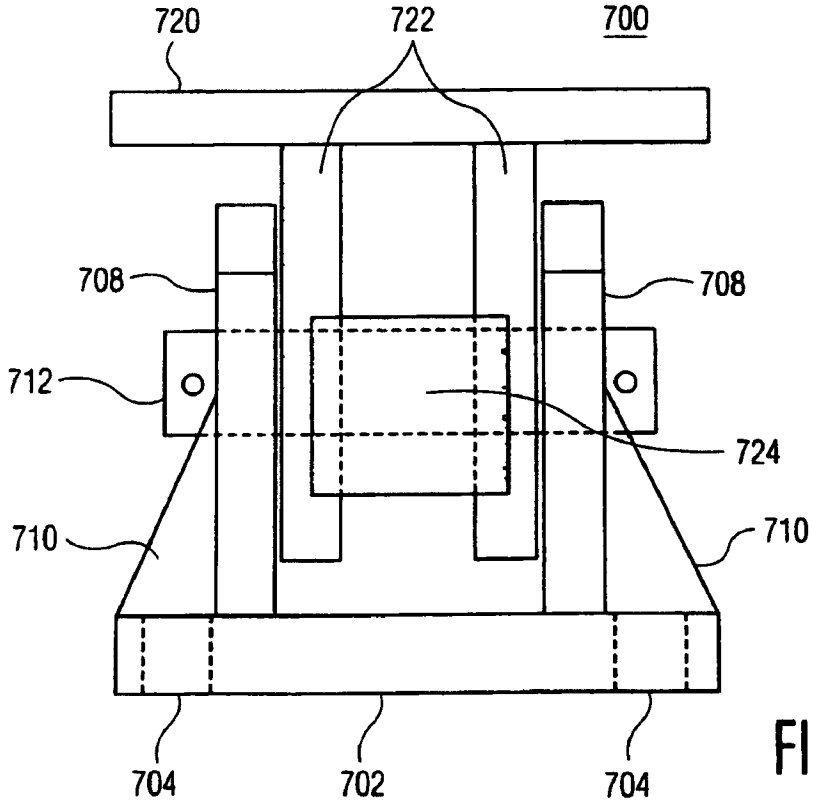
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FIG. 7B

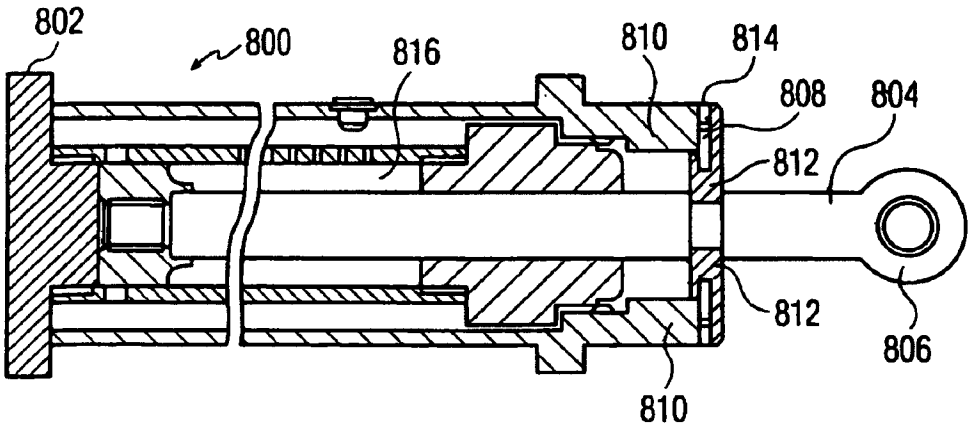
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FIG. 8A

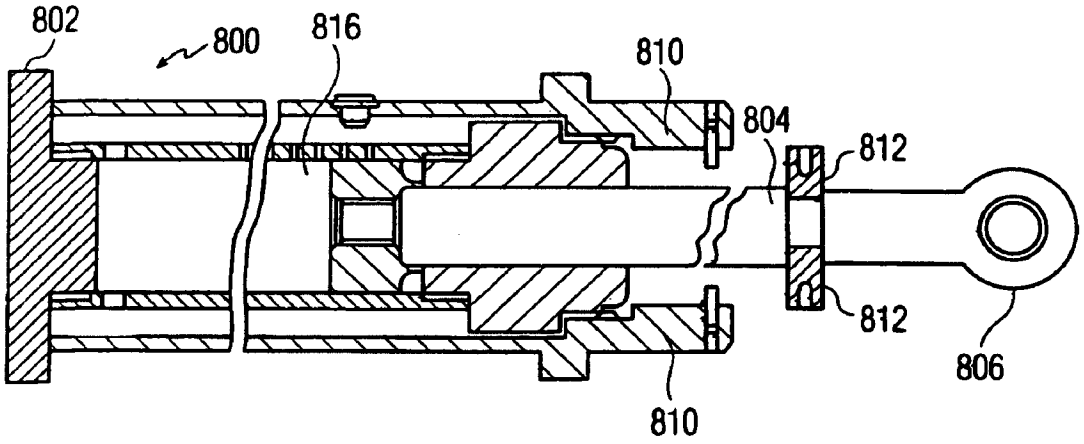
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FIG. 8B

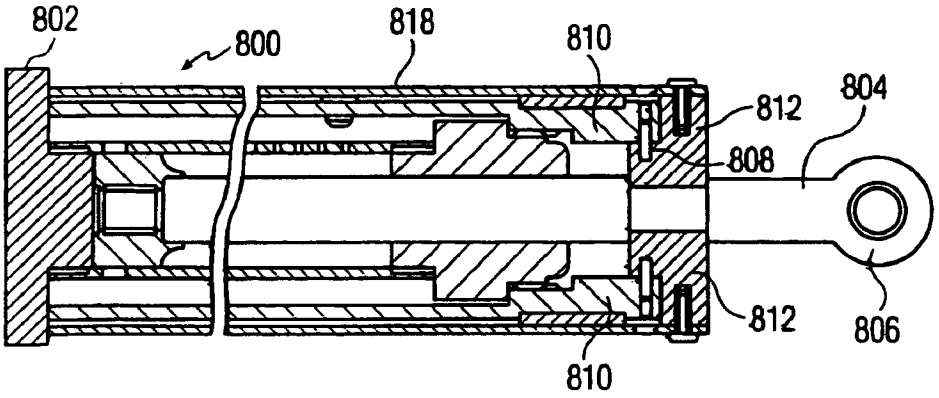
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FIG. 9A

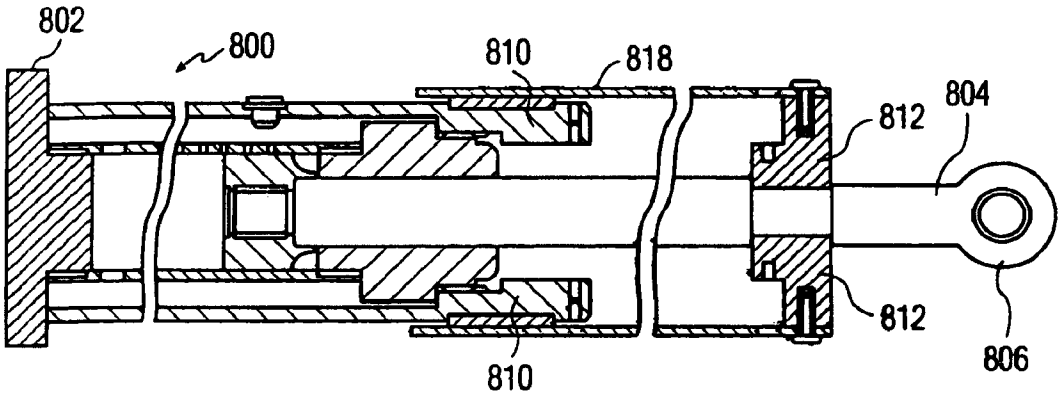
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FIG. 9B

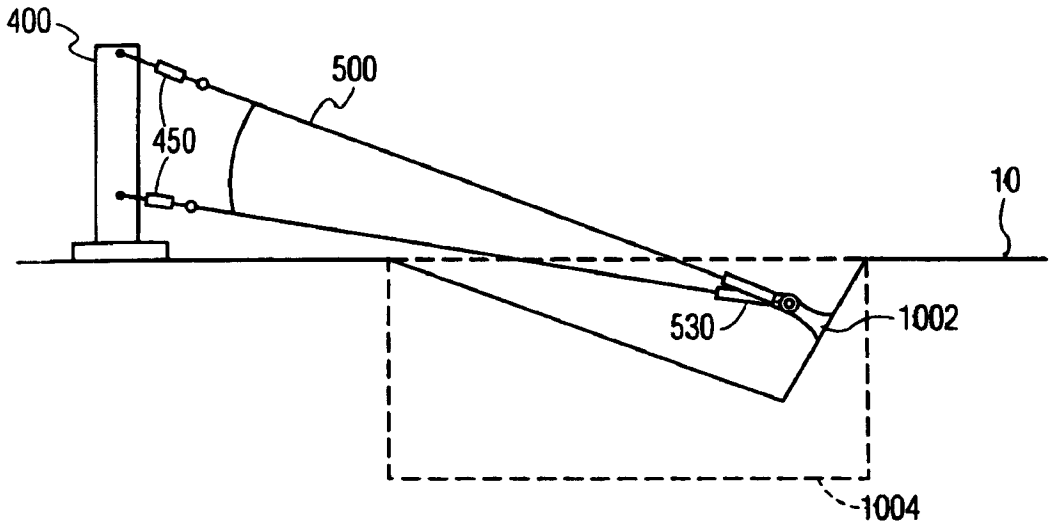

FIG. 10

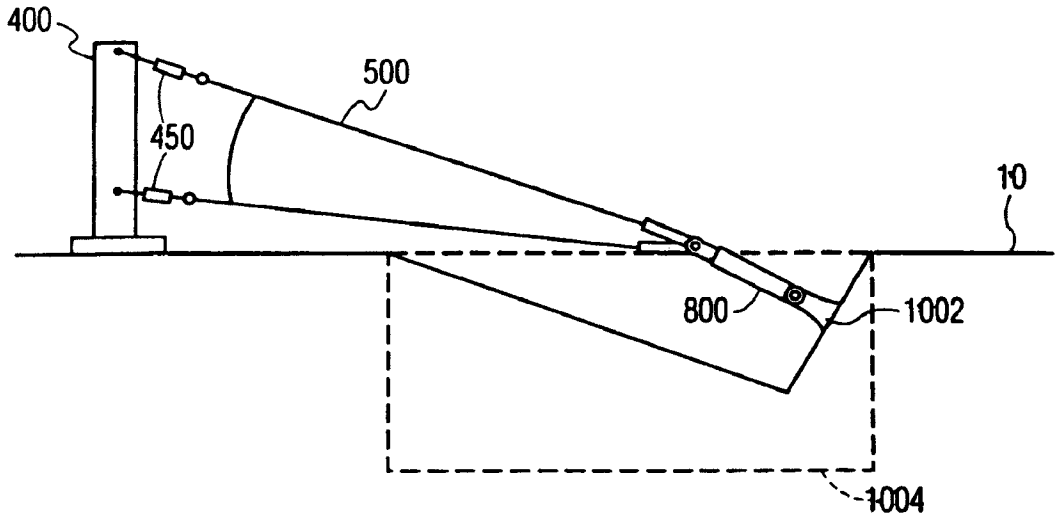

FIG. 11

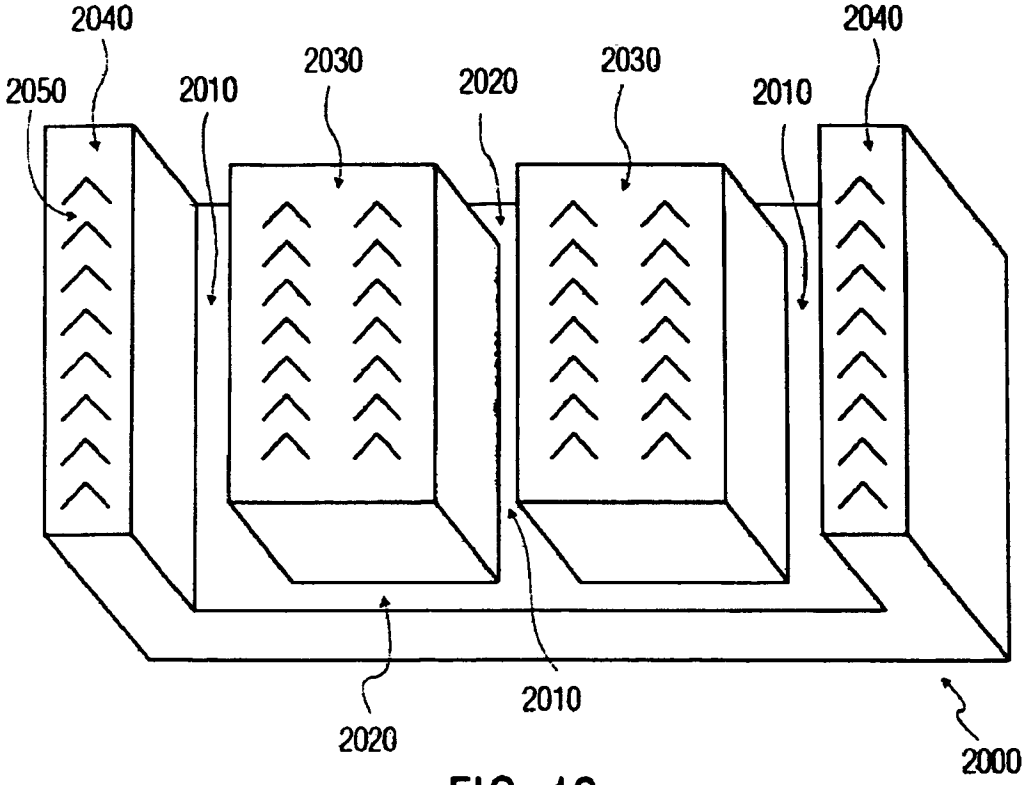
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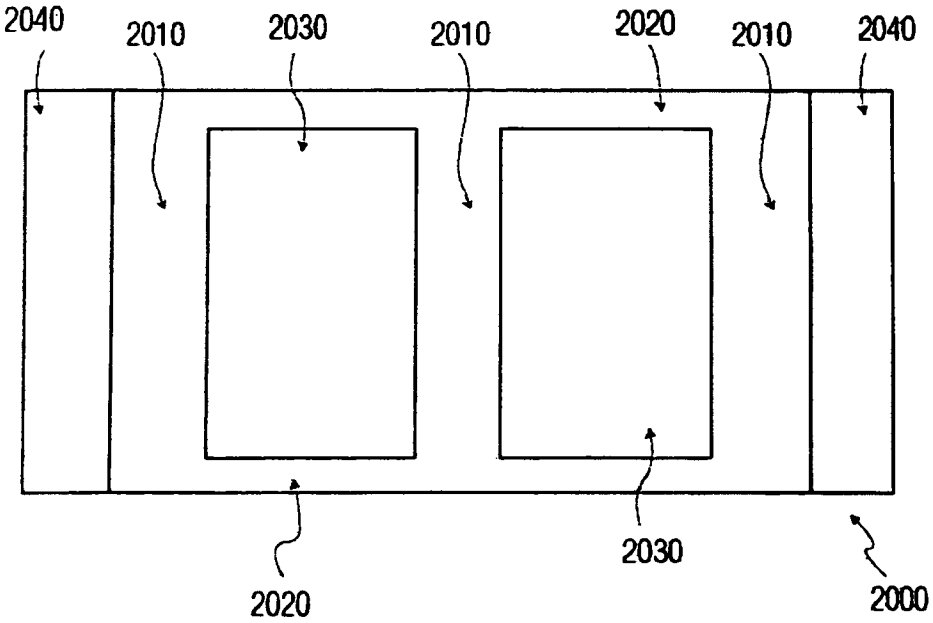
FIG. 12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2040
2020
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2000

FIG. 13

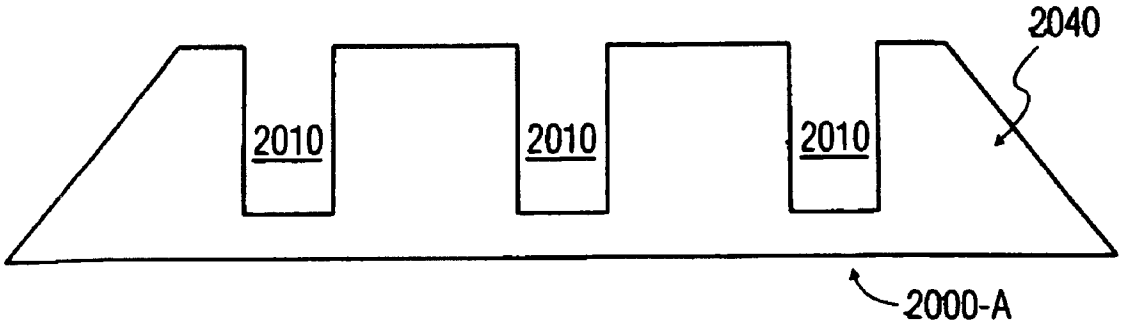


FIG. 14A

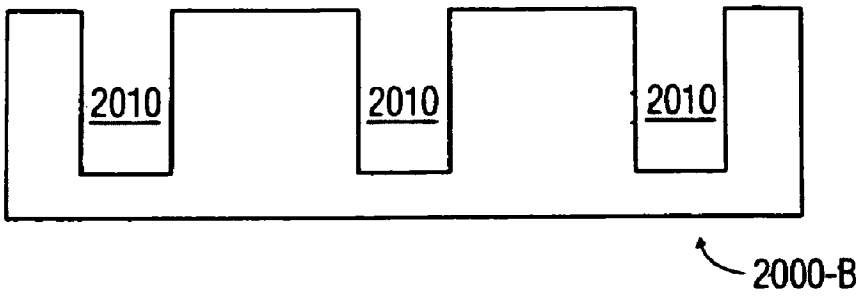


FIG. 14B

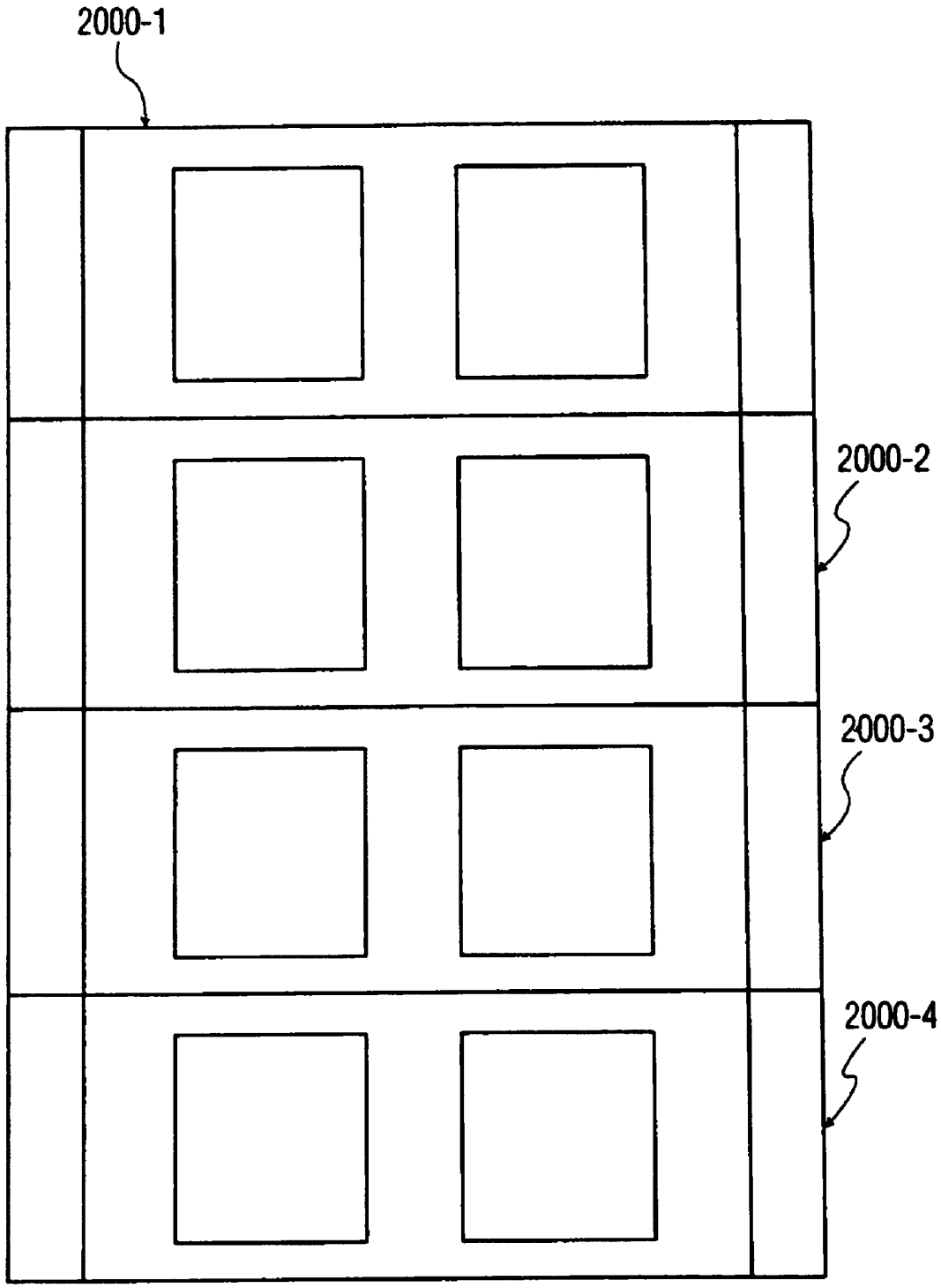


FIG. 15

NET AND MAT

This application claims priority to U.S. Provisional Patent Application No. 60/557,868 for Energy Absorbing System with Support, filed Mar. 31, 2004, which is hereby incorporated by reference.

BACKGROUND

This invention relates to a net and a mat, and more specifically to a modular mat that can accommodate the net and provide protection from a passing vehicle.

SUMMARY OF THE DISCLOSURE

The present disclosure relates to a energy absorbing system. In one aspect, the energy absorbing system spanning a roadway and including a net spanning the roadway, the net having a connecting member coupled to a top member, a middle member and a bottom member, and a mat arranged on the roadway, having a plurality of recesses to accommodate the net, when the net is in a lowered position.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG **1** is a perspective view which illustrates an energy absorbing system with support arranged at a railroad crossing of a single-lane roadway according to one aspect of the system of the present disclosure.

FIG **2** is a perspective view which illustrates an energy absorbing system with support arranged at a railroad crossing of a single-lane roadway and restraining a vehicle according to one aspect of the system of the present disclosure.

FIG **3**A is a side view of a stanchion, joint, shock absorber and capture net according to one aspect of the system of the present disclosure.

FIG **3**B is a side view of a stanchion and capture net according to one aspect of the system of the present disclosure.

FIG **4**A is a front view of a support, breakaway device and capture net according to one aspect of the system of the present disclosure.

FIG **4**B is a side view of a support according to one aspect of the system of the present disclosure.

FIG **4**C is a side view of a support according to one aspect of the system of the present disclosure.

FIG **5** is a front view of a capture net according to one aspect of the system of the present disclosure.

FIG **6**A is a top view of a bearing sleeve clamp according to one aspect of the system of the present disclosure.

FIG **6**B is a side view of a bearing sleeve clamp according to one aspect of the system of the present disclosure.

FIG **7**A is a side view of a joint according to one aspect of the system of the present disclosure.

FIG **7**B is a top view of a joint according to one aspect of the system of the present disclosure.

FIG **8**A is a side view of a shock absorber in a compressed state according to one aspect of the system of the present disclosure.

FIG **8**B is a side view of a shock absorber in an expanded state according to one aspect of the system of the present disclosure.

FIG **9**A is a side view of a shock absorber in a compressed state according to one aspect of the system of the present disclosure.

FIG. **9**B is a side view of a shock absorber in an expanded state according to one aspect of the system of the present disclosure.

FIG. **10** is a side view which illustrates an energy absorbing system with support arranged at a roadway according to one aspect of the system of the present disclosure.

FIG. **11** is a side view which illustrates an energy absorbing system with support arranged at a roadway according to one aspect of the system of the present disclosure.

FIG. **12** is a perspective view of a mat element according to one aspect of the system of the present disclosure.

FIG. **13** is a top view of a mat element according to one aspect of the system of the present disclosure.

FIG. **14**A is a side view of a mat element according to one aspect of the system of the present disclosure.

FIG. **14**B is a side view of a mat element according to another aspect of the system of the present disclosure.

FIG. **15** is a top view of four mat elements according to one aspect of the system of the present disclosure.

DETAILED DESCRIPTION

The energy absorbing system in one aspect may comprise an anchor or other mechanism for providing a fixed point, for example, a stanchion, one or more energy absorbing mechanisms coupled to the anchor for absorbing forces, a restraining capture net or other barrier coupled to one or more the energy absorbing mechanisms, and a support or other mechanism for supporting the restraining capture net or other barrier. In another aspect, the restraining capture net or other barrier may be coupled to the anchor without an energy absorbing mechanism between the restraining capture net and stanchion.

In another aspect, the support may be attached to the restraining capture net or other barrier via a frangible breakaway mechanism which breaks and thereby decouples the support and the restraining capture net in response to tensile forces that meet or exceed a minimum threshold force. In one aspect, it is envisioned that static tension from the restraining capture net in its quiescent state would not exceed this minimum threshold force, but that increased tension due to the dynamic forces exerted upon the frangible breakaway mechanism from a vehicle driving into the restraining capture net would exceed this minimum threshold force.

In another aspect, the support may be attached to the restraining capture net via a non-frangible connector and the support may be disturbed by the impact of the vehicle, or the non-frangible connector may expand or extend. In another aspect, the support may include a frangible or releasable portion, for example, a post, which decouples the support from the net in response to a minimum threshold force. In another aspect, the support may include a retractable mechanism for supporting the restraining capture net from above.

In yet another aspect, the support may be raised and lowered, thereby raising and lowering the restraining capture net or other barrier which it supports.

The energy absorbing mechanism may be mounted for rotation about the axis and be expandable in a direction substantially orthogonal to the axis. In another aspect, the energy absorbing mechanism may be a shock absorber, braking mechanism, or other friction damper, and may include a securing mechanism such that an expandable section of the energy absorbing mechanism, for example, a piston, does not expand except in response to tensile forces that meet or exceed a minimum threshold force. In one aspect, the static tension from the restraining capture net in

its quiescent state will not exceed this minimum threshold force, and increased tension due to the dynamic tensile forces exerted upon the shock absorber from a vehicle driving into the restraining capture net would exceed this minimum threshold force.

Referring to the drawings, wherein like reference numerals represent identical or corresponding parts throughout the several views, and more particularly to FIG. **1**, a general layout of an embodiment according to one aspect of the system of the present disclosure is shown installed at a railroad crossing. A roadway is indicated generally by reference numeral **10** and railroad tracks are indicated generally by reference numeral **20**. A capture net **500** is stretched across roadway **10** parallel to tracks **20**. Capture net **500** extends between anchors, for example, stanchions **300**, and supports **400** located on opposite sides of roadway **10**. The capture net **500** may be coupled at each end to a braking mechanism, for example, shock absorbers **800** which in turn may be coupled to a joint **700**, which may be coupled to a bearing sleeve **330** surrounding stanchion **300**, as described in greater detail below.

In FIG. **1**, the shock absorbers **800** are substantially parallel to roadway **10**, and shock absorber pistons **804** are in a compressed state. In this aspect, the supports **400** are arranged with respect to stanchions **300** in a manner such that, on impact, the pistons **804** may extend in a direction substantially the same as the direction in which the vehicle **30** is traveling.

The capture net **500** may be coupled to supports **400** via a breakaway connector **450**. The supports **400**, which may be raised and lowered, are shown in a raised position in FIGS. **1** and **2**. When supports **400** are lowered, the capture net **500** may rest in a position such that vehicles may drive over the capture net **500** unimpeded. In another aspect, when supports **400** are lowered, capture net **500** may be tucked into, for example, a slot cutout spanning roadway **10**, and having sufficient depth and width to accommodate some or all of the capture net **500**; such a cutout may be incorporated into a speed-bump. In a further aspect, when supports **400** are lowered, capture net **500** may be tucked into, for example, one or more mat elements (e.g., **2000-1** to **2000-N**) spanning roadway **10**.

Shown at the top of FIG. **2** is a vehicle **30** which has crashed into capture net **500** and is restrained by capture net **500** to prevent it and its occupants from encroaching onto tracks **20**. Capture net **500** has been deflected by the collision from its quiescent state so as to form a shallow "V" shape. Bearing sleeve **330** has rotated about stanchion **300** and shock absorbers **800** are now pointed inward toward roadway **10**, with shock absorber pistons **804** no longer in a compressed state. Joints **700** may pivot vertically depending on certain factors such as, for example, the height of the vehicle impact with capture net **500**. Further, breakaway connectors **450** have been severed, and, therefore, supports **400** no longer support capture net **500**.

The ability of capture net **500** to be deflected, yet provide a restraining force, allows vehicle **30** to be progressively stopped, thereby lessening adverse effects of the impact forces acting on vehicle **30** and its occupants. The deflecting and restraining functions are achieved by a unique energy absorbing system, described in greater detail below.

FIG. **3A** is a side view of a stanchion, joint, shock absorber and capture net according to one aspect of the system. Stanchion **300** may include a pipe **302**, which may be reinforced by inserting, a bar or other support (not shown) therein, may be filled with concrete (not shown) and embedded into a concrete base **320**, which has been poured into the ground. Stanchion **300** has an axis **310**, which may be a vertical axis, whose function will become clear hereinafter.

The system of the present disclosure may also include a bearing sleeve **330** fitted around stanchion **300** and which may be rotatable about stanchion **300**. Bearing sleeve clamps **600** fitted around stanchion **300** may be used to prevent bearing sleeve **330** from sliding vertically on stanchion **300**. Bearing sleeve **330** and bearing sleeve clamps **600** may be fabricated from pipe having approximately the same inner diameter as the outer diameter of stanchion **300**.

An example of a bearing sleeve clamp **600** according to one aspect of the system of the present disclosure is shown in FIGS. **6A** (top view) and **6B** (side view). As shown in FIGS. **6A** and **6B**, bearing sleeve clamp **600** may include a sleeve clamp ring **602** attached to a sleeve clamp flange **604** for securing about stanchion **300**. Sleeve clamp flange **604** may contain one or more holes **606** for accommodating one or more bolts or other securing mechanisms.

Returning to FIG. **3A**, stanchion **300** may be coupled to capture net **500** via shock absorber **800** and joint **700**. Accordingly, cable ends **530** of top cable **510** and bottom cable **520** may be coupled to piston connectors **806**, using a pin or other mechanism. Shock absorber **800** may have a shock absorber flange **802** which may be secured using bolts to joint front flange **702**. Joint rear flange **720** may be secured to bearing sleeve **330**, by a weld, bolts or other means to a bearing sleeve flange (not shown) coupled to bearing sleeve **330**. Alternatively, joint **700** may be omitted, with shock absorber flange **802** secured to bearing sleeve **330**, by a weld, bolts or other suitable means, to the bearing sleeve flange.

In another aspect, a crossbar **900** may be attached vertically between two or more cables, joints **700**, or shock absorbers **800** arranged on a stanchion **300**. The crossbar **900** may alleviate vertical torque on the cables, joints **700** and shock absorbers **800**, which might otherwise occur due to the fact that a vehicle **30** colliding with the capture net **500** may cause the top cable **510** and bottom cable **520** and, therefore, the joints **700** and shock absorbers **800** connected thereto, to tend to squeeze together. Thus, the crossbar **900** may act as a stabilizer against this vertical torque. The crossbar **900** may also cause top and bottom pistons **804** to expand with increased uniformity upon impact by vehicle **30**. In one aspect, the crossbar **900** may be formed of a rigid material such as, for example, steel or other hard metal. In another aspect, crossbar **900** may be constructed of non-rigid material, for example, cable.

FIG. **3B** shows a side view of a stanchion and capture net according to another aspect of the system of the present disclosure. In this aspect, shock absorbers **800** are not present, and cable ends **530** may be coupled to the stanchion **300** or bearing sleeve **330**. In other aspects, cable ends **530** may be coupled to joint front flange **702**, or joint inner prongs **722** using pin **712**. In each of these aspects, because shock absorbers **800** are not present, vehicle **30** will come to a halt in a shorter distance with greater deceleration. In these aspects, capture net **500** may be constructed of cable having a greater strength than in a system in which shock absorbers **800** are present.

FIGS. **4A** (front view), **4B** (side view) and **4C** (side view) show a support **400** according to one aspect of the system of the present disclosure. As shown in FIGS. **4A** and **4B**, the support **400** may include a post **402**, which may include top cable securing point **404** for attaching, for example, a breakaway connector **450** to top cable **510**, and bottom cable securing point **406** for attaching, for example, a breakaway connector **450** to bottom cable **520**.

Post **402** may be inserted into a spool **426** around which a spring **424** is coiled in a manner such that in the spring's uncompressed state, post **402** is in an upright, vertical position as shown in FIGS. **4**A and **4**B. Post **402** may pivot with the spool **426** in the direction shown by arrow **430**. Spring **424** and spool **426** may be encased in housing **410** which may include top plate **412**, base plate **414**, and side plates **420**, as well as back plate **418** and back support **422**. Post **402** may also include securing point **408** which may be used by a raise-lowering mechanism (not shown). Post **402** may also include a hook or other device (not shown) for connecting to a latching mechanism which may be placed on the ground or incorporated as part of an extension of housing **410** and which secures the post **402** when the spring **424** is in a compressed state.

In another aspect, a levered system or a powered drive system, for example, an electric motor, located within or external to housing **410** may be used in place of the spring-based system described above.

As shown in FIG. **4**C, post **402** may have a raised and lowered position. Support **400** may be positioned such that, in the lowered position, the distal end of post **402**, i.e. that end not in contact with spool **426**, is pointed in the direction of oncoming vehicle **30**.

As described above, breakaway connector **450** disconnects the support **400** and the capture net **500** in response to forces that meet or exceed a minimum threshold force. In one aspect, static tension from the capture net **500** in its quiescent state would not exceed this minimum threshold force, but increased tension due to the dynamic tensile forces exerted upon the breakaway connector **450** from a vehicle **30** driving into the capture net **500** would exceed this minimum threshold force.

An eyebolt—turnbuckle—cable—clamp combination may be used to couple support **400** to capture net **500** and act as breakaway connector **450**. The eyebolt may connect to top cable securing point **404**. The eyebolt then may be coupled to an adjustable turnbuckle which may control the height and/or tension of capture net **500** when the support **400** is in the upright position. The other end of the adjustable turnbuckle may by coupled to a cable, for example, a 5/16 inch cable, which couples to a cable clamp attached to capture net **500**. It may be expected that at least the 5/16 inch cable will break, thereby disconnecting turnbuckle and cable clamp, when the minimum threshold force is exceeded. It will be apparent to one skilled in the art that, according to this aspect of the system of the present disclosure, the type, style and thickness of breakaway connector **450** used will depend on a number of factors, including, but not limited to, the type of capture net **500** and the amount of static tension applied to capture net **500** in its quiescent state.

Breakaway connector **450** and surrounding equipment may also include one or more of the following, alone or in combination: a turnbuckle, cable, come-along, bolt, or other frangible connection device. It will be apparent to one skilled in the art that a mechanism may be used for both its tensioning and frangible properties.

The raise-lowering mechanisms controlling post **402** may be under the control of a standard train-detecting system, such as is commonly used to control gates at railroad crossings. In operation, a control system (not shown) may sense the presence of an oncoming train and may thereby control capture net operations. In addition to railroad crossings, the system can also be used in a variety of other applications, including HOV lane traffic control, drawbridges, security gates, or crash cushion applications. One can readily appreciate that the control system for such applications may differ from that used in a railroad crossings. At security gates, for example, the capture net **500** may be in a raised position, and actuation of the security system (e.g., by a guard, a key card, keyboard punch, etc.) would lower the barrier and permit passage. In another application, the capture net **500** may be in a lowered position and raised when warranted, for example, in an emergency.

In another aspect, the support **400** may be attached to the restraining capture net **500** via a non-frangible connector. In this aspect, the non-frangible connector will not uncouple the support **400** from the capture net **500** in response to the threshold force. In one such aspect, the support **400** may be disturbed by the impact of the vehicle **30**. In another aspect, the support **400** may be integrated into the net **500**. In another aspect, the non-frangible connector may expand or extend in response to a threshold force. In another aspect, the non-frangible connector may compress in response to a threshold force.

In yet another aspect, the support **400** may include a frangible or releasable portion, for example, the post **402** may decouple the support **400** from the capture net **500** in response to a minimum threshold force.

In another aspect, the support **400** may include a retractable mechanism (not shown) for supporting the restraining capture net **500** from above.

FIG. **5** shows a capture net **500** which includes a top cable **510** and bottom cable **520**, each having cable ends **530**, where the top cable **510** and bottom cable **520** may be coupled by a number of vertical cables **540**. The vertical cables **540** may be coupled by a center cable **550**.

Vertical cables **540** may be coupled to center cable **550**, for example, by using a u-bolt, or the two may be interwoven. In another aspect of the system of the present disclosure, the vertical cables **540** may be, for example, woven into the top cable **510** and bottom cable **520**. Other suitable nets may be used.

FIGS. **7**A and **7**B show side and top views, respectively, of joint **700** according to one aspect of the system of the present disclosure. A prong stop plate **706**, may make contact with joint rear flange **720** to support the weight of the capture net **500** and shock absorber **800** and may prevent joint front flange **702** from pivoting downward beyond a predetermined level, for example, a horizontal level. Joint outer prongs **708** may be supported by joint outer prong supports **710** which attach to joint front flange **702** and fit on either side of joint inner prongs **722**. Joint inner prongs **722** attach to joint rear flange **720** and may be supported by joint inner prong support **724**. Joint outer prongs **708** and joint inner prongs **722** may be rotatably fixed using a pin **712**, thereby allowing shock absorber **800** to pivot on a vertical plane. Joint front flange **702** may have bolt holes **704** for securing to shock absorber flange **802**.

FIGS. **8**A and **8**B show a side view of a shock absorber in a compressed state and expanded state, respectively. Shock absorber **800** has shock absorber flange **802** which may couple to joint front flange **702**.

Shock absorber piston **804** may be removably attached to capture net **500** via a piston connector **806**, which may be an eyelet extension, through which a cable, clamp or other appropriate securing mechanism may be passed in order to secure the cable end **530** to the shock absorber piston **804**.

Prior to vehicle **30** colliding with capture net **500**, shock absorber **800** may be in a compressed state and may be secured by a threshold force securing mechanism. The threshold force securing mechanism may be capable of withstanding a predetermined threshold tensile force. In one aspect, a threshold force securing mechanism includes one

or more shear pins **808** which may be inserted through a shear pin collar **810** into a shear pin ring **812**. A number of shear pins **808**, for example, four, may be arranged radially about the longitudinal axis of shock absorber **800**. The shear pin collar **810** may be integral or separate from other parts of the shock absorber. The shear pin **808** may be a self-setting screw type pin or shear pin **808** optionally may be secured by a set screw **814**. Other threshold force securing mechanisms can be used in combination with, or instead of, a shear pin. For example, a securing mechanism such as a brake pad, a counterweight, or other counter-force may be used. The threshold force securing mechanism allows the shock absorber **800**, without expanding from its compressed state, to assist the support **400** in pulling capture net **500** taut. The shock absorber **800** on the other side of roadway **10**, in an identical configuration, will assist the other corresponding support **400** in pulling the other side of the capture net **500** taut.

Capture net **500** may be installed with a pre-tension horizontal load, for example, 1,000–20,000 pounds, on its cables. This load will depend on a number of factors including, but not limited to, the length of capture net **500**, the desired height of capture net **500**, and construction and materials of the capture net **500**.

When a vehicle **30** collides with capture net **500**, the vehicle deflects the capture net **500**, causing it to exert a tensile force exceeding the minimum threshold force upon shock absorber **800**. When the threshold force securing mechanism includes shear pins **808**, the tensile force causes the shear pins **808** to shear and thereby permits the expansion of piston **804** of shock absorber **800** against the resistance of the hydraulic fluid in cylinder **816** (FIG. **8**B). Shock is thereby absorbed during its expansion, while the force of the capture net **500** may rotate shock absorber **800** and bearing sleeve **330**, and may cause joint **700** to pivot about a horizontal axis. Forces applied upon capture net **500** are thereby translated through the center of stanchion **300**, which is solidly anchored in foundation **320**. Therefore, energy may be distributed among and absorbed by capture net **500**, the shock absorbers **800**, joint **700** and the stanchion **300**.

The shock absorbing mechanism may alternatively include a torque protection structure as illustrated in FIGS. **9**A and **9**B, which show side views in a compressed and expanded state, respectively. According to this aspect, shock absorbers **800** include a protective sleeve **818** which may be coupled to and travel with piston **804** in order to add structural strength to resist deformation of the housing or other parts of the shock absorber **800** due to the torque that the capture net **500** exerts upon capturing a vehicle and deflecting shock absorbers **800**. The protective sleeve **818** may be made of any suitable structural material, for example, aluminum or steel.

FIG. **10** is a side view which illustrates an energy absorbing system with support **400** arranged at a roadway according to one aspect of the system of the present disclosure. Net **500** is connected to an anchor, for example, a tie back **1002**, which may be located above, at, or below ground level. In the aspect shown, cable ends **530** of top cable **510** and bottom cable **520** are each coupled to tie back **1002** which is embedded below ground level in concrete **1004** alongside roadway **10**. In another aspect, each of top cable **510** and bottom cable **520** may be coupled to a separate tie back **1002**. In another aspect, tie back **1002** may be coupled to net **500** via a socket (not shown).

FIG. **11** is a side view which illustrates an energy absorbing system with support **400** arranged at a roadway according to one aspect of the system of the present disclosure. Net **500** is coupled to a shock absorber **800** which is coupled to an anchor, for example, a tie back **1002**, which may be located above, at, or below ground level. In the aspect shown, cable ends **530** of top cable **510** and bottom cable **520** are each coupled to shock absorber **800** which is coupled to tie back **1002** which is embedded below ground level in concrete **1004** alongside roadway **10**. In another aspect, each of top cable **510** and bottom cable **520** may be coupled to any combination of shock absorbers **800** and tie backs **1002**.

An embodiment similar to that shown in FIGS. **1** and **2** was constructed as follows. It will be apparent to one skilled in the art that size and thickness of the materials used will vary based on, for example, the expected potential energy encountered by the system, determined by such factors as the expected size and velocity of the vehicles to be arrested.

The overall width of the installation was 12 feet centerline to centerline of the stanchions **300**. The capture net **500** width was 25 feet, and included top cable **510**, bottom cable **520** and center cable **550** spaced 1.5 feet apart and coupled by seven vertical cables **540** spaced 1.5 feet apart. The uninstalled constructed capture net **500** height was 3 feet. The height of the capture net **500** when installed and tensioned was 50.25 inches to the center of the top cable and 15.75 inches to the center of the bottom cable as measured at the centerline of the capture net **500**. The top cable **510** and bottom cable **520** were 1.25 inch 6×26 galvanized MBL 79 tons, the vertical cables **540** and center cable **550** were ⅝ inch 6×26 galvanized MBL 20 tons, and the vertical cables **540** were coupled to the top cable **510** and bottom cable **520** by swage sockets. Cable ends **530** were also swage sockets.

Cable ends **530** of top cable **510** and bottom cable **520** were coupled to the stanchion **300** via shock absorber **800**, joint **700** and bearing sleeve **330** at points 2 feet 10 inches and 1 feet 7 inches as measured from ground level to the cable center point, respectively.

In an aspect where shock absorbers **800** are not present, top cable **510** and bottom cable **520** may be, for example, 1.5 inch thickness, and center cable **550** and vertical cables **540** may be ¾ inch thickness.

In another aspect a 50 foot capture net **500** may be used for a 36 foot distance between stanchions **300**, which may include top cable **510**, bottom cable **520** and center cable **550** spaced 1.5 feet apart coupled by twenty-three vertical cables **540** spaced 1.5 feet apart.

The supports **400** were located 13 feet in front of, and 3 feet to the outside of the stanchions **300**, with a pole **402** height of 4 feet 8 and ⅝ inches and top securing height of 4 feet 7 inches and bottom securing height of 1 feet 8 inches.

Concrete base size may vary by installation and application. In the embodiment constructed, the hole used for the concrete base **320** was measured as 15 feet in direction vehicle **30** was traveling, 27 feet between stanchions **300** and 3.5 feet deep.

The spring **424** used had 1000 ft lbs torque, an inner diameter of 9 inches and an outer diameter of 11 inches. Joint front flange **702** included four holes for bolting to shock absorber flange **802**. Joint rear flange **720** was welded to bearing sleeve **330**. Pin **712** had a length of 10 and ¾ inches and diameter of 2 and ⅜ inches.

The shock absorbers **800** used were hydraulic with about a 130,000 pound resistance with a 36 inch stroke and had an accumulator with a 5,000 pound return force for use with a 15,000 pound, 50 mph vehicle impact. The length of shock absorber **800** was 97 inches extended and 61 inches compressed, with a diameter of 10.8 inches.

Stanchion **300** included a 2 inch thick steel pipe, which had a 16 inch outside diameter and was 94 inches long. The stanchion **300** was reinforced by inserting a 4 inch thick steel bar, which had a width of 11.3 inches and length of 94 inches. Stanchion was filled with concrete and was embedded approximately 3.5 feet deep below ground level and extended approximately 3.8 feet above ground level.

Bearing sleeve **330** was 31" long. Bearing sleeve clamp **600** had an outside diameter of 18 inches. Sleeve clamp flange **604** included two holes **606** to accommodate two bolts for tightening about stanchion **300**. Bearing sleeve clamp **600** had an inner diameter of 16 inches and was fabricated of the same material as bearing sleeve **330**.

FIG. **12** shows perspective view of a mat element **2000**. In one embodiment, a mat element **2000** may include horizontal recesses **2010** having sufficient depth and width to accommodate some or all of the horizontal cables (i.e., top **510**, middle **550**, and bottom **520**) of the capture net **500**. In such an embodiment, the mat element **2000** may further include vertical recesses **2020** having sufficient depth and width to accommodate some or all of the vertical cables **540**. As shown in FIG. **12**, the horizontal recesses **2010** and vertical recesses **2020** may be defined in whole or in part by projections **2030** and ends **2040**.

An upper surface of a mat element **2000** (i.e., a surface upon which a vehicle **30** may pass) may include traction member **2050** such as bumps, recesses, or both. In one embodiment, a mat element **2000** is made of rubber. In alternative embodiments, however, the mat element **2000** may be made of other acceptable materials—for example, materials sufficient to protect the capture net **500** from damage when a vehicle **30** passes over the capture net **500** in its lowered or resting position.

In one embodiment, mat **2000** was 3'8" long and 1'6" wide. Projections **2030** and ends **2040** were 4" high, measured from bottom surface to top surface. Projections **2030** were 1'2⅝" long and 1'3" wide. Vertical recesses **2020** were 3'3¾" long and 1½" wide. Horizontal recesses **2010** were 1'6" wide. Top and bottom horizontal recesses **2010** were 3¾" long, and middle horizontal recess **2010** was 3" long. Distance from top surface of horizontal recesses **2010** and vertical recesses **2020** to top surface of projections **2030** was 3". Ends **2040** were 2⅛" long.

As shown in FIGS. **1** and **15**, a number of mat elements **2000** may be joined to one another or otherwise placed next to one another to span a roadway **10**. After use, certain or all of the mat elements **2000** spanning a particular roadway **10** may be replaced by one or more new mat element **2000** without replacing all of the mat elements **2000** necessary to span the roadway **10**.

As shown in FIG. **14**A, one aspect of the mat element **2000** may include ends **2040** that have a sloped profile to allow a vehicle to pass over the mat element **2000** with greater ease. Other mat elements, as shown in FIG. **14**B, may not include ends **2040** having a sloped profile.

Although illustrative embodiments have been described herein in detail, it should be noted and will be appreciated by those skilled in the art that numerous variations may be made within the scope of this invention without departing from the principle of this invention and without sacrificing its chief advantages.

Unless otherwise specifically stated, the terms and expressions have been used herein as terms of description and not terms of limitation. There is no intention to use the terms or expressions to exclude any equivalents of features shown and described or portions thereof and this invention should be defined in accordance with the claims that follow.

What is claimed is:

1. An energy absorbing system spanning a roadway, comprising:

a net spanning the roadway, the net having a connecting member coupled to a top member, a middle member and a bottom member; and

a mat arranged on the roadway, having a plurality of recesses to accommodate the net, when the net is in a lowered position.

2. The energy absorbing system of claim **1**, wherein the plurality of recesses include a connecting member recess, a top member recess, a middle member recess, and a bottom member recess.

3. The energy absorbing system of claim **2**, wherein the connecting member recess extends from the top member recess to the bottom member recess.

4. The energy absorbing system of claim **1**, wherein the mat comprises, a plurality of mat elements arranged contiguously.

5. The energy absorbing system of claim **4**, wherein each of the plurality of mat elements includes at least a first recess and a second recess.

6. The energy absorbing system of claim **1**, wherein the plurality of recesses include a top horizontal recess, a middle horizontal recess and a bottom horizontal recess; and a first vertical recess and a second vertical recess, each extending from the top horizontal recess to the bottom horizontal recess.

7. The energy absorbing system of claim **6**, wherein the first vertical recess and the second vertical recess extend along an outer edge of the mat.

8. The energy absorbing system of claim **6**, wherein a top end is formed by the top horizontal recess and a bottom end is formed by the bottom horizontal recess.

9. The energy absorbing system of claim **8**, wherein the top end and the bottom end are sloped downward away from a center horizontal line of the mat.

10. The energy absorbing system of claim **1**, wherein the mat is rubber.

11. The energy absorbing system of claim **1**, wherein a portion of a top surface of the mat is textured.

12. An energy absorbing system spanning a roadway, comprising:

a net spanning the roadway, the net having a connecting member coupled to two of a top member, a middle member and a bottom member; and

a mat arranged on the roadway, having a connecting member recess, a top member recess, a middle member recess, and a bottom member recess to accommodate the connecting member, the top member, the middle member and the bottom member, when the net is in a lowered position.

* * * * *

Exhibit 6

SecureUSA, Inc.
Perimeter Defense Solutions

GRAB System

Product Overview

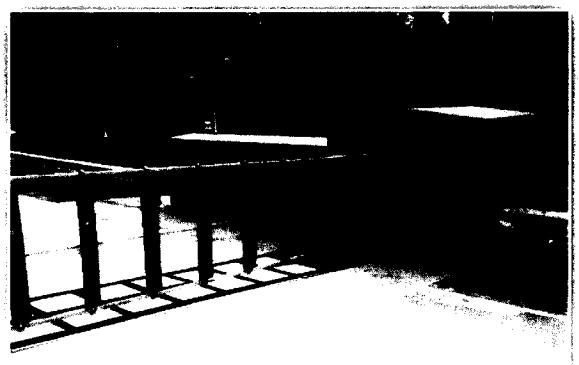
Patent Pending

The Bottom Line:

The Ground Retractable Automobile Barrier (GRAB) is a Smart Barrier system, with roots in cutting - edge vehicle stopping technology. Placed at strategic access control points such as roads, entry ways, bridges, or tunnels the GRAB system secures and protects your facility from terrorist aggressors. To secure an area or block an entrance, the GRAB system raises a steel net housed in a recessed area in a roadway.

Sidewalk Bollard™ Features:

- K4, K8, & K12 Certification
- Non Hydraulic
- Non Lethal Barrier
- Automatic / Manual Operation
- Resets In 30 Seconds
- Bi-Direction Operation
- Multiple Lanes One Unit
- Custom Design Options
- Lowest Vehicle Damage



Why Choose SecureUSA, Inc.?

Experience:

- SecureUSA, Inc. has over 1,200 successful installations.
- We have over ten years of experience in physical security.
- We can take your project from start to finish with no hassle.

Equipment:

- Active Bollards
- Passive Bollards
- Decorative Bollard Sleeves
- Street Furniture
- Vehicle Barriers
- Fencing
- Gates
- Access Control
- Guard Booths

Services:

- Equipment Selection
- System Design
- Project Installation
- Service and Maintenance

Benefits:

Non Lethal / Energy Absorption
The GRAB system utilizes a customized steel net that traps the vehicle upon impact. Unlike traditional vehicle barriers that are fixed the GRAB system responds to the speed and weight of the vehicle and rapidly slows down the vehicle to a complete stop. The factor alone improve your sites safety and reduces the risk of security accidents taking place.

Crash Certification & Rating
The GRAB system has been certified and crash test by the Department of State (DOS) at the K4, K8, and K12 levels. These crash ratings are respectively 15,000 lbs. @ 30, 40, and 50 mph. The GRAB system carriers one of the highest crash ratings and is completely capable of protecting your facility.

Aesthetically Pleasing
The GRAB system has several aesthetic options that can improve the landscape of your entrance or roadway wherever the system is being installed. With the GRAB your can secure your facility while making it improving is landscape and architecture as well.

Low Installation & Maintenance Costs
Because of its electric operation the GRAB system is both easy to install and maintain this creates a cost savings for you in the short and long run while also reducing life cycle costs compared to other vehicle barriers.

The Look You Want... The Security You Need!

SecureUSA, Inc.
4250 Keith Bridge Road
Cumming, GA 30041

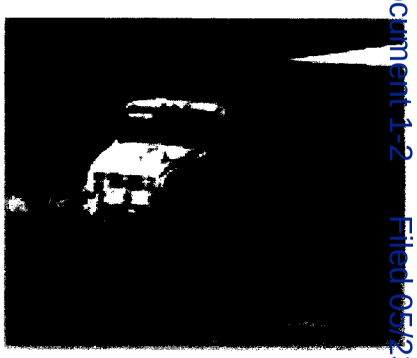
Phone 888.222.4559
Fax 770.889.7939
www.SecureUSA.net

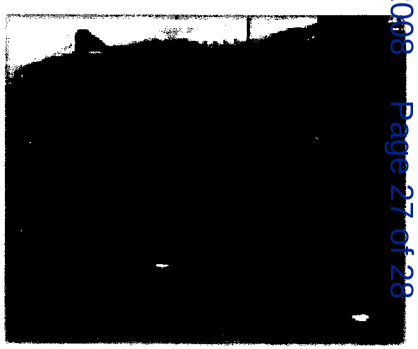
Exhibit 7

Download Product Overview & Details (PDF)

Back

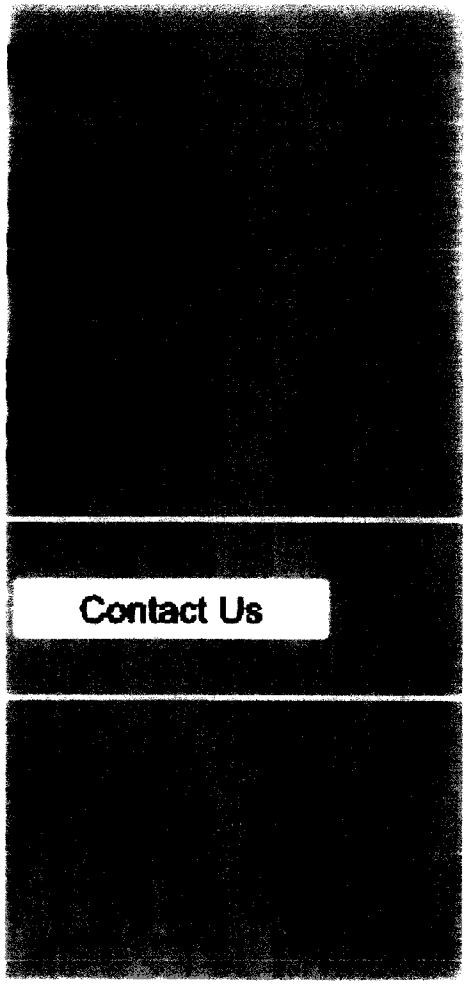
The non lethal GRAB system carrier up to a K12 crash rating protecting your most critical assets and roadways. To secure an area or block an entrance, the GRAB system raises a steel net housed in a recessed area in a roadway. Because is can quickly, effectively, and safely stop vehicles the GRAB system protect innocent people, preserves evidence, and allows for rapid recovery.





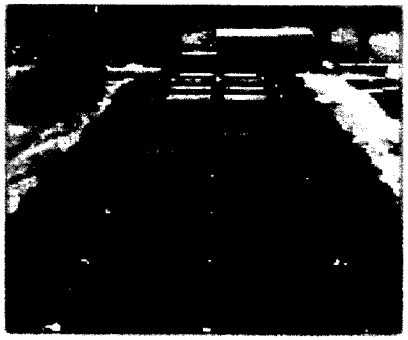
Features:

- Low installation, operation, and maintenance costs
- Very cost effective because of reusability
- Can be resent and reused in minutes after impact
- No re-installation construction costs
- Numerous installation options and flexibility



- Can be resent and reused in minutes after impact
- No re-installation construction costs
- Numerous installation options and flexibility
- Can protect multiple lanes (8 to 60 feet wide)
- Visitor friendly appearance that blends in with surroundings

The GRAB system utilizes superior technology to most traditional vehicle barriers. Its benefit to both industries in the public and private sector have quickly made it one of the fastest growing barrier technologies.



Home > Products > Vehicle Barriers > GRAB System